# RECORDERS N4450

00/15/19/43

# Service manual

584A

HILIPS

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SERVICE

Subject to modification

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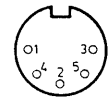
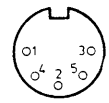
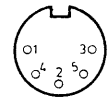
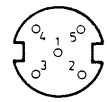
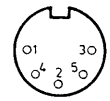
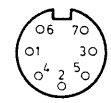
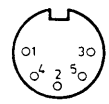
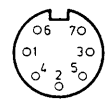
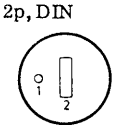
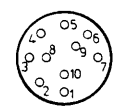
TECHNICAL SPECIFICATION

| | |
|---|---|
| Mains voltages | : 110-127-220-240 V |
| Mains frequency | : 50 - 60 Hz (timer must be adapted only) |
| Power consumption | : min. 29 W<br>max. 120 W |
| Number of tracks | : 4 |
| Tape speeds | : 4.75 cm/sec - 1 7/8 ips (± 2 %)<br>9.5 cm/sec - 3 3/4 ips (± 1 %)<br>19 cm/sec - 7 1/2 ips (± 1 %) |
| Max. reel diameter | : 26.5 cm ($10\frac{1}{2}$") |
| Number of heads | : 6 (2 recording, 2 playback, 2 erase heads) |
| Number of motors | : 4 (one Hall motor - collectorless d.c. motor - for driving the capst<br>two d.c. motors for driving the reel discs, one synchronous motor f |
| Wow and flutter | : 4.75 cm/sec ≤ 0.35 %<br>9.5 cm/sec ≤ 0.2 %<br>19 cm/sec ≤ 0.15 % |
| Winding time<br>26 cm reel with LP tape (1080 m)<br>18 cm reel with LP tape ( 540 m) | <br>: ≤250 secs<br>: ≤150 secs |
| Input sensitivities:<br>Micro<br>Tape<br><br>Tuner<br>Phono<br><br>Aux | <br>: 0.15 mV/ >2 kΩ<br>: 2 mV/ 20 kΩ (1, 4)<br>100 mV/ 1 MΩ (3, 5)<br>: 100 mV/100 kΩ<br>: 1.5 mV/ 47 kΩ (MD/ceramic HiFi)<br>100 mV (X-tal)<br>: 2 mV/ 20 kΩ (1, 4)<br>100 mV/ 1 MΩ (3, 5) |
| Output voltages:<br>Tape<br>Monitor<br>Headph | <br>: 1 V/ >50 kΩ<br>: 1 V/ >50 kΩ<br>: 3 V/400-600 Ω |
| Output power | : 2 x 20 W (d < 1 % - 8 Ω) |
| Frequency range (within 6 dB) | : 4.75 cm/sec 60 - 8, 000 Hz<br>9.5 cm/sec 40 - 15, 000 Hz<br>19 cm/sec 40 - 20, 000 Hz<br>40 - 16, 000 Hz (with stereofilter) |
| Rumble filter | : -10 dB at 30 Hz |
| Scratch filter | : -15 dB at 15 kHz |
| Physiological tone control | : +14 dB at 50 Hz,<br>+ 6 dB at 10 kHz |
| Erase frequency | : 100 kHz (± 10 %) |
| Dimensions (including lid) | : 520 x 500 x 210 mm (20 1/2" x 19 5/8" x 8 3/8") |
| Weight | : approx. 20 kg (44 lbs) |

INPUTS AND OUTPUTS

| Marking | For connection of | Sensitivity | Impedance | Kind of socket | Connection | Place |
|---|---|---|---|---|---|---|
| MICRO L + ST<br>BU8 | a microphone with either 3-pole, 180°, DIN plug for recording any channel in position 1-4, 3-2 and for recording left-hand channel in position ST, or with 5-pole, 180°, DIN plug for stereo recording | 0.15 mV *) | >2 kΩ | 5p, 180°, DIN  | 1 - left<br>4 - right<br>2 - ⊥<br>5 -<br>3 - | front |
| MICRO R<br>BU9 | a microphone with either 3 or 5-pole, 180°, DIN plug for recording the right-hand channel in position ST | 0.15 mV *) | >2 kΩ | 5p, 180°, DIN  | 1/4 - right<br>2 - ⊥<br>5 -<br>3 - | front |
| TAPE IN/OUT<br>BU2<br>BU10 | a second tape recorder or any apparatus provided with a 5-pole 180° DIN in/output socket:<br>input : pins 1 and 4<br>pins 3 and 5<br>output : pins 3 and 5 | <br><br><br>2 mV<br>100 mV<br>1 V | <br><br><br>20 kΩ<br>1 MΩ<br>>50 kΩ | 5p, 180°, DIN  | 1 - left<br>4 - right<br>2 - ⊥<br>5 - left<br>3 - right | rear<br>front |
| HEADPH.<br>BU11 | a stereo headphone, provided with a 5-pole, symmetrical DIN plug | 3 V | 400-600 Ω | 5p, sym. DIN  | 1 -<br>2 - ⊥<br>3 - ⊥<br>4 - left<br>5 - right | front |
| TUNER<br>BU1 | a tuner | 100 mV | 100 kΩ | 5p, 180°, DIN  | 1 -<br>4 -<br>2 - ⊥<br>5 - right<br>3 - left | rear |
| PHONO<br>BU4 | a record player with either a crystal, a ceramic, or a dynamic P.U. element. The input sensitivity for crystal and ceramic HiFi/dynamic P.U. elements can be set by means of a switch underneath the socket to<br>crystal<br>ceramic HiFi/dynamic | <br><br><br><br><br>100 mV **)<br>1.5 mV | <br><br><br><br><br>-<br>47 kΩ | 7p, DIN  | 1 - right<br>4 -<br>2 - ⊥<br>5 - right<br>3 - left<br><br>6 - MP1<br>7 - MP101 | rear |
| AUX.<br>BU3 | any kind of electronic musical equipment, e.g. an electronic organ, or a tape recorder, a record player with a crystal P.U. element<br>input : pins 1 and 4<br>pins 3 and 5 | <br><br><br>2 mV<br>100 mV | <br><br><br>20 kΩ<br>1 MΩ | 5p, 180°, DIN  | 1 - left<br>4 - right<br>2 - ⊥<br>5 - right<br>3 - left | rear |
| MONITOR<br>BU5 | a monitor amplifier | 1 V | > 50 kΩ | 7p, DIN  | 1 -<br>4 -<br>2 - ⊥<br>5 - right<br>3 - left<br><br>6 - MP2<br>7 - MP102 | rear |
| LOUDSP. L<br>LOUDSP. R<br>BU6<br>BU7 | a loudspeaker enclosure either 4 Ω or 8 Ω | - | <br><br>4 Ω/8 Ω<br>4 Ω/8 Ω | 2p, DIN  | <br><br>1 - 4 Ω/8 Ω<br>2 - ⊥ | rear |
| REMOTE<br>BU201 | the remote control unit N6719 (optional) | - | - | 10p  692A | 1 - recording<br>2 - stop<br>3 - fast wind left<br>4 - fast wind right<br>5 - pause<br>6 - ⊥<br>7 - left/right<br>8 - right<br>9 - -26 V<br>10 - left | rear |

*) In case only one mono microphone is connected, and the track selector is in position 1-4 or 3-2 (mono) the sensitivity is 0.2 mV at > 2 kΩ.

**) Measured with series capacity of 2, 000 pF.

REMOVING THE CABINET (see Fig. 1 and 2)

- Remove the five screws A at the rear to take off the rear panel.
- The black ornamental plate at the front can be removed after loosening the five screws A and removing the switch knob between the two turntables.
  Also remove the head covers D; these can be slid forwards off the mounting pins.
- In most cases it is recommendable to take the complete amplifier unit out of the cabinet for repairs to this unit.
  For this, remove the five screws B and screw C in the middle above the ornamental surround of the switches.
  The complete unit can now be carefully slid forwards out of the cabinet.
  The amplifier unit is connected to the rest of the circuitry with three wire forms, viz.:
  a. one thick wire form between the switch p.c. board and the amplifier board. This wire form is connected to the amplifier board by means of connectors.
  b. one three-fold wire form between the heads p.c. board and the amplifier board.
  c. two wires between the mains switch and the timer.

Attention
The wires mentioned under c. carry mains voltage. A warning plate is fitted near the place where the wires are plugged onto the connection tags at the rear left of the recorder.

When fitting the amplifier unit, check that the wire forms do not touch the flywheels. The flywheel bracket has been provided with a cable tie for fixing wire form b.

Replacing the buttons 168 and the switch wipers

- Buttons 168 can be withdrawn from the switch wipers by pulling them forwards.
- Remove the two output amplifier units P8/P108.
- Push the spring slightly back and remove the pawl and spring.
- Remove the pin from the switch wiper; the wiper can now be pulled forwards out of the switch.
- When refitting the wiper, the stop spring should be slightly lifted so that it fits into the labyrinth.

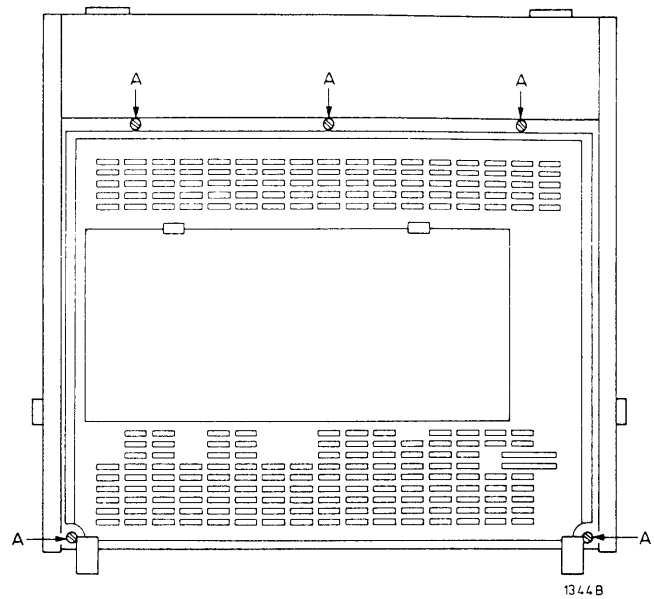



Fig. 1

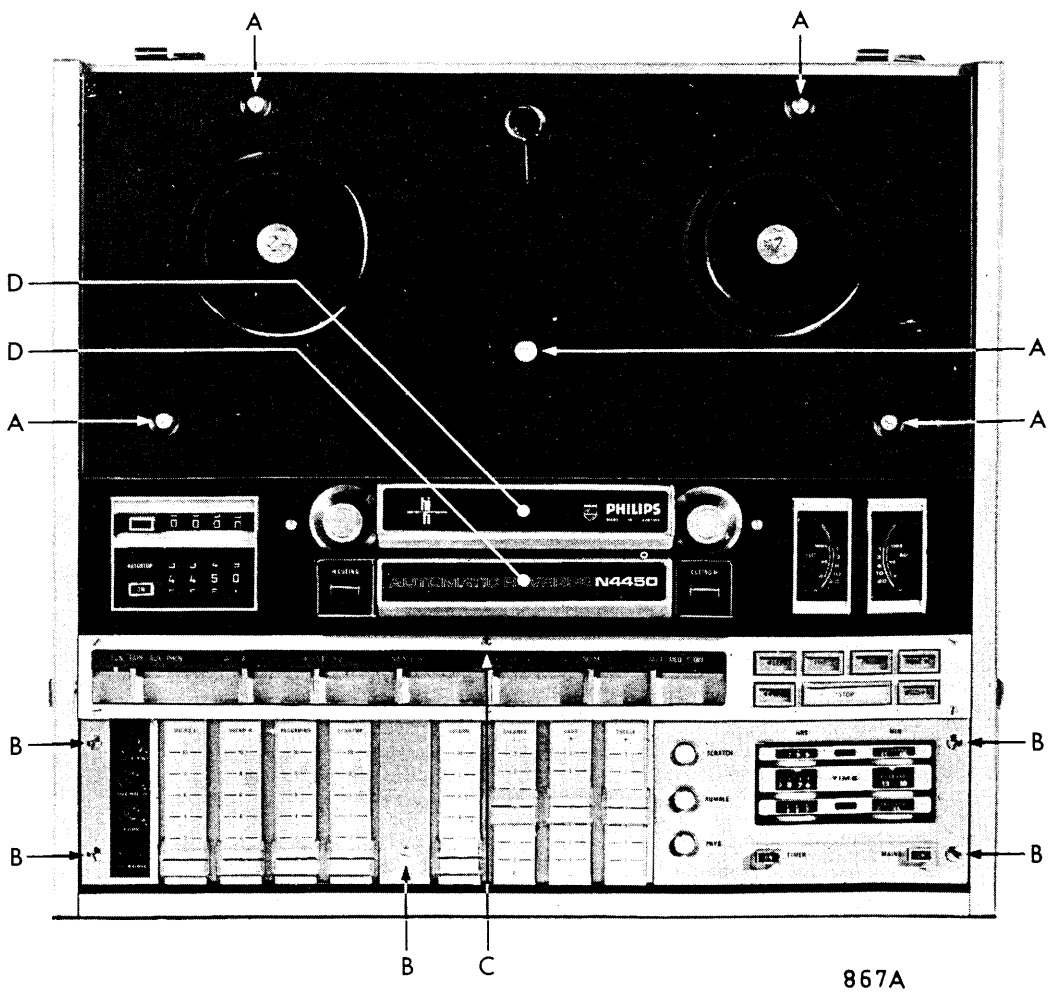



Fig. 2

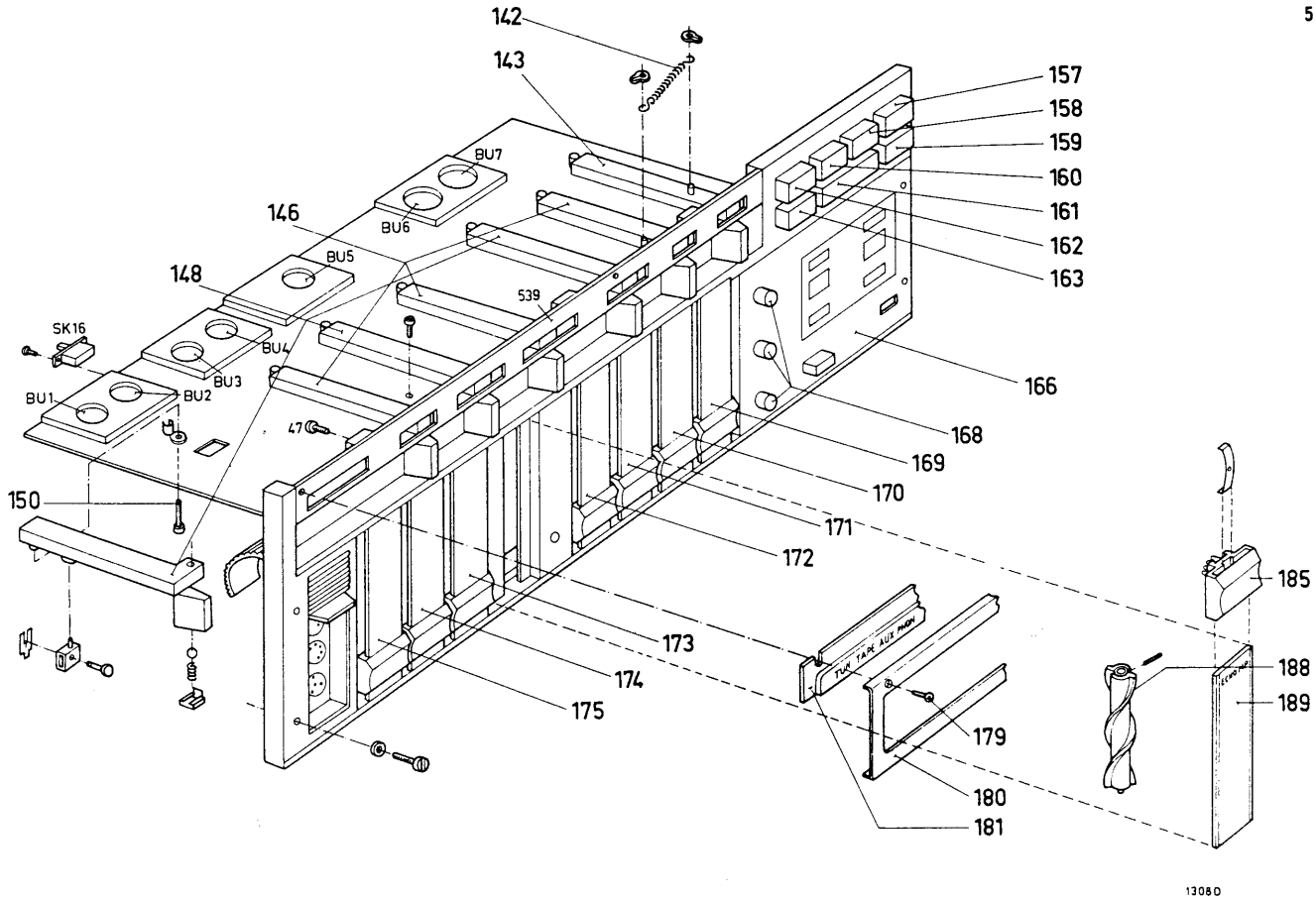



Fig. 3

REPAIR HINTS (see Fig. 3)

Amplifier unit

To remove this unit, see "Removing the cabinet".

Replacing the switch brackets 143/146/148

- Remove the ornamental surround 180 round the switches and buttons (9 Philips head screws), indication strip 181 and bracket 539.
- Remove the 3 screws 47 with which the stop bar of the switch brackets is secured and lift the bracket slightly.
- Loosen the screw on which the switch bracket to be replaced hinges (for "FAST-MED-SLOW" switch also detach spring 142).
- Replace the switch bracket, taking care that the switch wiper engages the relevant opening in the bracket.

Replacing the recorder control buttons 157...163

- Remove the ornamental surround 180 round the switches and buttons (9 Philips head screws), indication strip 181 and bracket 539.
- Bend the tags on the edge of ornamental plate 166 round the buttons, aside.
- Pull out the spindle on which the buttons are hinged.
- The button can now be replaced.
- Refit the spindle and bend the tags back.
- Refit the ornamental surround etc.

Replacing the slide controls 185 and panels 169...175, 189

- Remove the ornamental surround 180 round the switches and buttons (9 Philips head screws), indication strip 181 and bracket 539.
- Insert a screwdriver at the top between the panel of the slide control and the front panel (see Fig. 4).
- Prize off the glued panel with the screwdriver.
- When refitting, check that the control 185 just fits over wormwheel 188 of the potentiometer.
- To fit the panel, apply some glue.

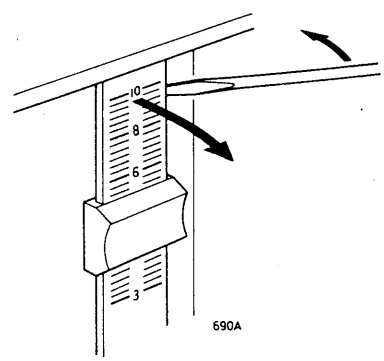



Fig. 4

ELECTRICAL CHECKS AND ADJUSTMENTS

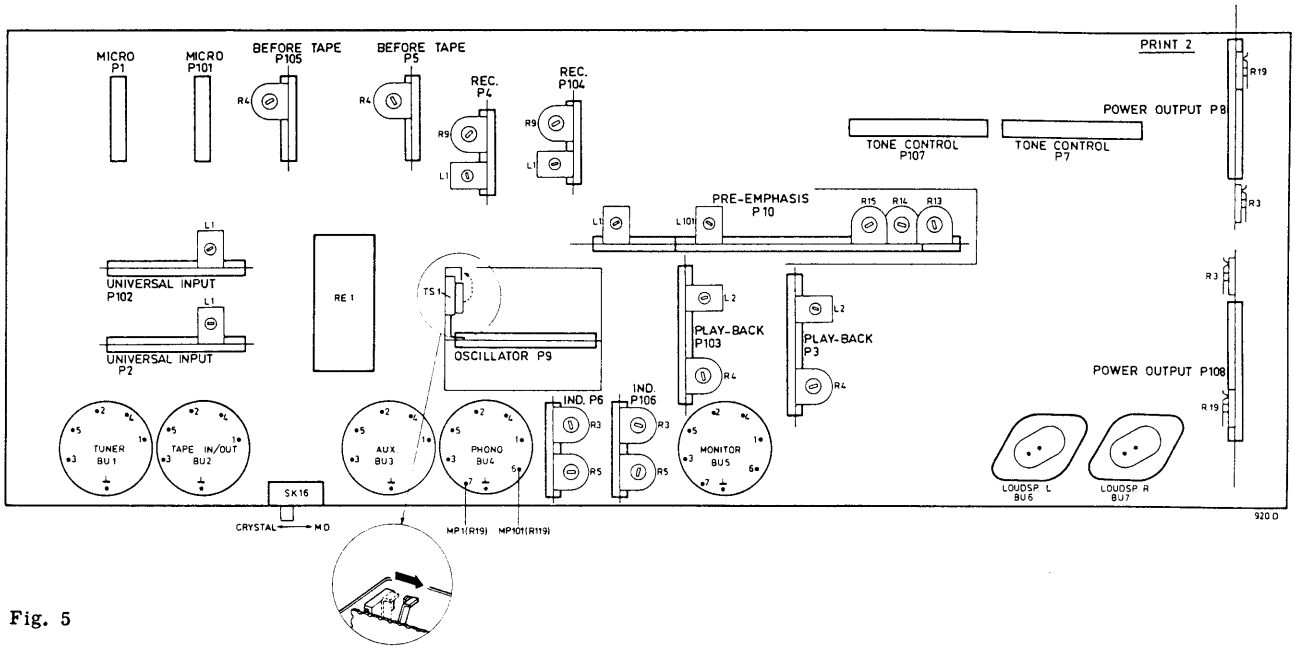



Fig. 5

Required test equipment

| | |
|---|---|
| Multi-meter 40 kΩ/V | P 81700 or PM 2411 |
| RF millivoltmeter | GM 6012 or PM 2454 |
| AF signal generator | GM 2317 or PM 5105 |
| Reference tape | 8222 305 1138 (according to DIN 45513) |

I. FUNCTIONAL UNITS

## P1/P101 MICRO INPUT UNIT

This unit requires no adjustments.

## P2/P102 UNIVERSAL INPUT UNIT

Recorder set
to position : recording-"TUN"-"B"-"ST"-"NOR"-"19"
potentiometer "RECORDING" to maximum;
other potentiometers to minimum

Rejection 19 kHz signal

| | | |
|---|---|---|
| Input | : BU1 TUNER 3/5 | 19 kHz - 1 V |
| Output | : BU5 MONITOR 3/5 | Adjust for min. voltage with L1 |

The unit supplied for service purposes has already been adjusted for max. rejection of the 19 kHz signal by the manufacturer.

## P3/P103 PLAYBACK UNIT

Recorder set
to position : playback-"ST"-"9.5"

| | | |
|---|---|---|
| Input | : BU5 MONITOR 6/7 (MP2/102) | 333 Hz - 330 mV |
| Output | : BU5 MONITOR 3/5 | Adjust for output voltage of 1 V with R4 |

Check:

| Input: BU5 MONITOR 6/7 | | Output: BU5 MONITOR 3/5 |
|---|---|---|
| 9.5 cm/sec | 40 Hz - 100 mV | 0.6 - 1 V |
| | 10 kHz - 1000 mV | 0.57 - 0.69 V |
| 19 cm/sec | 333 Hz - 100 mV | 0.27 - 0.33 V |
| | 40 Hz - 100 mV | 0.45 - 0.7 V |
| | 10 kHz - 1000 mV | 0.32 - 0.38 V |
| 4.75 cm/sec | 333 Hz - 100 mV | 0.28 - 0.34 V |
| | 40 Hz - 100 mV | 0.6 - 1 V |
| | 10 kHz - 1000 mV | 0.9 - 1 V |

Rejection of radiated erase oscillator signal (100 kHz)

Recorder set
to position : recording-"TAPE"-"A"-"ST"-"NOR"-"9.5"
potentiometer "RECORDING" to maximum;
other potentiometers to minimum; no tape on the set

| | | |
|---|---|---|
| Output | : BU5 MONITOR 3/5 | Adjust for minimum RF voltage with L2 |

The unit supplied for service purposes has already been adjusted for max. rejection of the erase oscillator signal by the manufacturer.

## P4/P104 RECORDING UNIT

Recorder set
to position : recording-"TAPE"-"B"-"ST"-"9.5"

| | | |
|---|---|---|
| Input | : BU2 TAPE IN/OUT 3/5 | 333 Hz - 1 V |
| Output | : BU5 MONITOR 5 | Adjust for 1 V with potentiometer "RECORDING" R721/751 |
| | BU5 MONITOR 3 | Value to be measured 1 V + x V (x = max. 0.8 V) Halve the difference with 1 V with R4 on P5 |
| | BU4 PHONO 6 (MP1) | Adjust for 1.5 mV with R9 on P4 *) |
| | BU5 MONITOR 5 | Value to be measured 1 V ± y V (y = max. 0.8 V) Halve the difference with 1 V with R4 on P105 If thereupon $\frac{x}{2} \neq \frac{y}{2}$, halve the difference voltage once more in respect of 1 V |
| | BU4 PHONO 7 (MP101) | Adjust for 1.5 mV with R9 on P104 *) |

*) To make sure that the bias current is measured as well, remove oscillator unit P9 from the apparatus (see Fig. 5).

Rejection 38 kHz signal

Recorder set
to position : recording-"TUN"-"B"-"ST"-"NOR"-"9.5"
potentiometer "RECORDING" to maximum;
other potentiometers to minimum
Input : BU1 TUNER 3/5 38 kHz - 0.1 V
Output : point 2 of unit P4/104 Adjust for min. amplitude of this 38 kHz signal with L1 (< 600 mV)

The unit supplied for service purposes has already been adjusted for max. rejection of the 38 kHz signal by the manufacturer.

## P5/P105 BEFORE TAPE UNIT

Recorder set
to position : recording-"TAPE"-"B"-"ST"-"NOR"-"9.5"
potentiometer "RECORDING" to maximum;
other potentiometers to minimum.
Input : BU2 TAPE IN/OUT 3/5 333 Hz - 100 mV
Output : BU5 MONITOR 3/5 Adjust for 1 V with R4

For further adjustments, see "RECORDING UNIT" (P4/104).

## P6/P106 INDICATOR UNIT

Recorder set
to position : "STOP"

Adjust R3 on P6 so that the left indicator gives a just noticeable deflection with respect to zero.
The same applies to R3 on P106.

Recorder set
to position : recording-"TAPE"-"B"-"ST"-"NOR"-"9.5"
Input : BU2 TAPE IN/OUT 3/5 333 Hz - 1 V
Output : BU5 MONITOR 3/5 Adjust for 1 V with potentiometer "RECORDING".

Adjust R5 on P6 so that the pointer of the left-hand indicator indicates 100 % (0 dB).
The same applies to R5 on P106.

## P7/P107 TONE CONTROL UNIT

This unit requires no adjustments.

## P8/P108 POWER OUTPUT UNIT

Recorder set
to position : "AMP"
all potentiometers to minimum

No input signal, if desired, short-circuit the input of the amplifier section (points 13 and 14).
Immediately after switching on, adjust the direct voltage on the output (points 4, 5) to +100 mV with R3.
Owing to the temperature rise, this value decreases to approx. +30 mV after a few minutes; if desired readjust with R3.

Adjusting the quiescent current

The quiescent current through TS7/TS8 must be adjusted to 50 mA with R19. Check value after 1 min. and if necessary readjust.
The quiescent current can be checked by measuring the voltage across R28//R30 (approx. 25 mV).
As the quiescent current through TS5/TS6 is negligible compared with that through TS7/TS8, it is also allowed to measure the current by connecting the measuring instrument instead of the fuse.

## P9 OSCILLATOR UNIT

The unit requires no adjustments.
Oscillator frequency : 100 kHz ± 10 %
Voltage measured across erase head K3/K6 : 36 - 40 V

## P10 PRE-EMPHASIS/SPEED SELECTOR UNIT

Recorder set
to position : recording-"TAPE"-"B"-"ST"-"NOR"-"4.75"
potentiometer "RECORDING" -20 dB (approx. 6);
other potentiometers to minimum
Input : BU2 TAPE IN/OUT 3/5 10 kHz - 100 mV
Output : BU4 PHONO 6/7 1.0 mV, to be adjusted with L1/L101

For adjustment of the tape speed, see under "Mechanical adjustments" Speed adjustment.

Adjusting the bias current

For this adjustment, use a new, non-modulated tape of good quality. Make sure that the magnetic heads are clean.

Recorder set
to position : recording-"TAPE"-"B"-"ST"-"NOR"-"19"
Input : BU2 TAPE IN/OUT 3/5 1 kHz - 1 V
Output : BU5 MONITOR 3/5 Adjust for 1 V with potentiometer "RECORDING". The indicators should deflect as far as 100 %.

Remove the core from the coil to be adjusted completely. Now adjust the core until the output voltage does not decrease any more. Secure the cores with wax. To check this adjustment, the distorsion and the frequency response of a recording can be measured. The after-tape distorsion should be ≤ 3 % at 1 kHz (100 % modulation).
For the correct values of the frequency response see the appropriate measurement.

## P203/P204 TAPE TENSION UNIT

For adjustment of the motor current, see under "Mechanical adjustments" Adjusting the tape tension.

## P201 RESET/AUTOMATIC REVERSE UNIT

## P202 MOTOR STOP UNIT

## P205/P206 FLIP-FLOP UNIT

## P207 SPEED CONTROL UNIT

These units require no adjustments.

## II. INPUT SENSITIVITIES

Recorder set
to position : "AMP"
potentiometers not mentioned set to minimum

| Input: | | Output: |
|---|---|---|
| "TUN"; potentiometer "RECORDING" maximum | | BU5 MONITOR 3/5 |
| BU1 TUNER 3/5 | 333 Hz - 100 mV | 0.75 - 1.25 V |
| "AUX" | | |
| BU3 AUX 3/5 | 333 Hz - 100 mV | 0.75 - 1.25 V |
| "PHON"-"DYN" (SK16); potentiometer "RECORDING" -20 dB (6) | | |
| BU4 PHONO 3/5 | 40 Hz - 1.2 mV | 0.56 - 1.32 V |
| | 333 Hz - 12 mV | 1.5 - 2.5 V |
| | 10 kHz - 12 mV | 0.14 - 0.34 V |
| "CRYST" (SK16);potentiometer "RECORDING" maximum; apply signal via 2000 pF | | |
| BU4 PHONO 3/5 | 40 Hz - 1 V | 0.32 - 0.76 V |
| | 333 Hz - 1 V | 0.6 - 1.4 V |
| | 10 kHz - 100 mV | 0.2 - 0.5 V |
| Potentiometers "MICRO L" and "MICRO R" maximum | | |
| BU8/BU9 MICRO 1/4 | 333 Hz - 0.15 mV | 0.75 - 1.25 V |

## III. FREQUENCY RESPONSE

Recorder set
to position : recording-"TAPE"-"A"-"ST"-"NOR"-"19"
all potentiometers to minimum
Input : BU2 TAPE IN/OUT 3/5 1 kHz - 1 V
Output : BU5 MONITOR 3/5 Adjust for 1 V with potentiometer "RECORDING". The indicators should deflect as far as 100 %

Now decrease the input voltage to 0.1 V (= -20 dB).
Make a recording of the following frequencies: 40 Hz - 60 Hz - 1 kHz - 8 kHz - 20 kHz. (The input voltage must remain the same.) The play-back frequency response which is now measured relative to 1 kHz, must be in accordance with the curve given in Fig. 6.
It is also possible to measure this curve at a speed of 9.5 cm/sec.
The highest frequency must now be 15 kHz (see Fig. 7).
In position "TUNER" and "AUX" a rejection filter for the stereo pilot signal is included.
This results in frequencies above 16 kHz being considerably attenuated, as can be seen in Fig. 8.
At the speed 4.75 cm/sec the frequency response in the range 60 ... 8000 Hz is within 6 dB.
For the complete frequency curve see Fig. 9.

## IV. CHECKING THE CROSS-TALK

Recorder set
to position : recording-"TAPE"-"B"-"ST"-"NOR"
potentiometer "RECORDING" to maximum;
other potentiometers to minimum

| Input: | Output: |
|---|---|
| BU2 TAPE IN/OUT 3<br>10 kHz - 100 mV | BU5 MONITOR 5 <50 mV |
| BU2 TAPE IN/OUT 5<br>10 kHz - 100 mV | BU5 MONITOR 3 <50 mV |

Cross-talk between inputs not used:

| | | |
|---|---|---|
| Input | : BU2 TAPE IN/OUT 3/5 | 10 kHz - 2 V |
| | BU3 AUX 3/5 | 10 kHz - 2 V |
| | BU4 PHONO 3/5 (SK16 DYN) | 10 kHz - 50 mV |
| | BU8/BU9 MICRO 1/4 | 10 kHz - 0.15 mV |
| Output | : BU5 MONITOR 3/5 | |

The voltage on points 3/5 of the monitor socket caused by cross-talk of the signal to the non-used sockets must not exceed 30 mV.

Cross-talk in position "1-4" - "3-2"

Tracks 1-4

| | | |
|---|---|---|
| Input | : BU5 MONITOR 6 | 15 kHz - 1 V |
| Output | : Point 2 P104 | <20 mV |

Tracks 3-2

| | | |
|---|---|---|
| Input | : BU5 MONITOR 7 | 15 kHz - 1 V |
| Output | : Point 2 P4 | <20 mV |

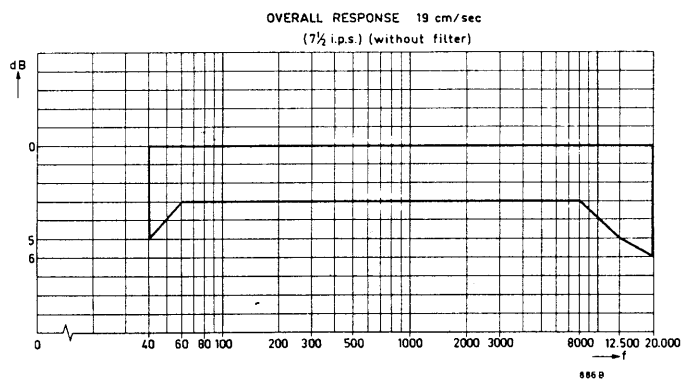



Fig. 6

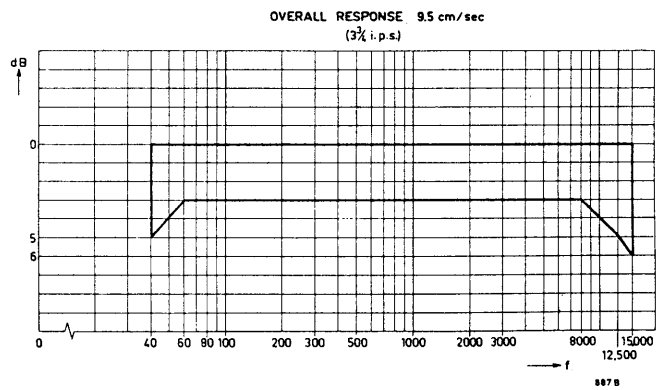



Fig. 7

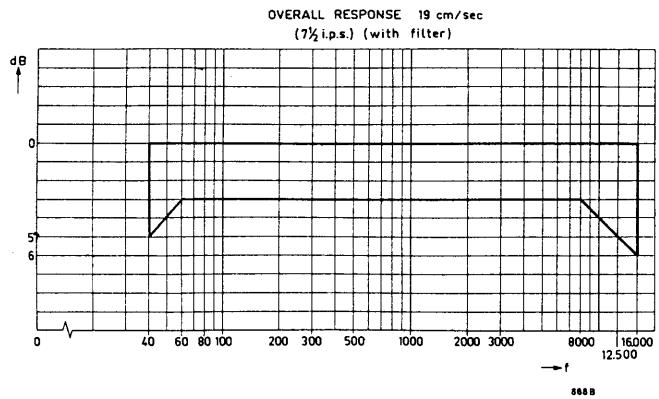



Fig. 8

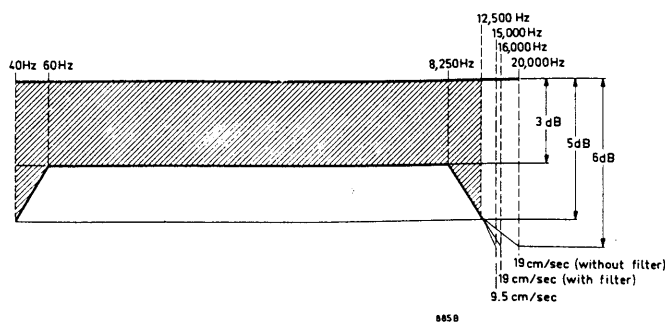



Fig. 9

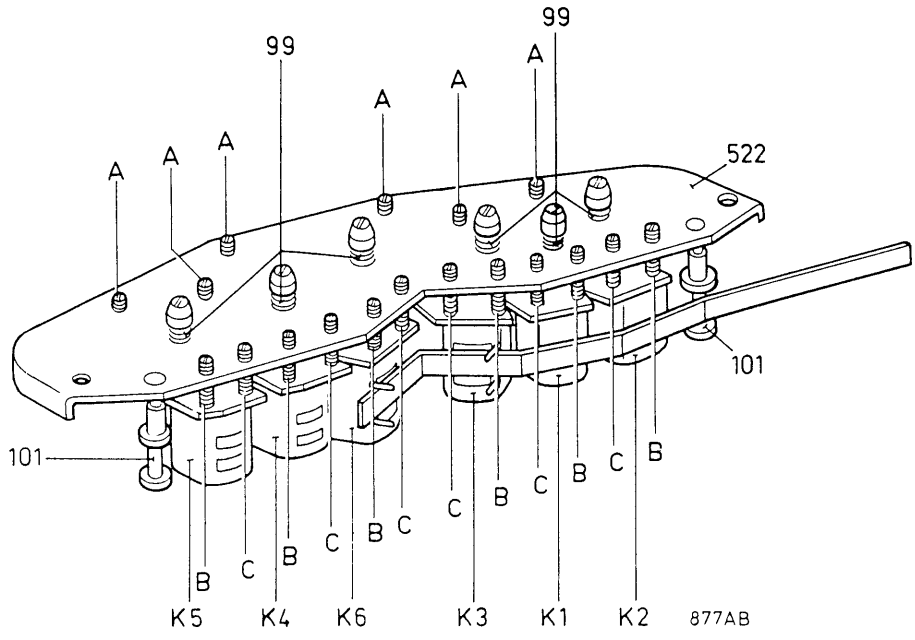



Fig. 10

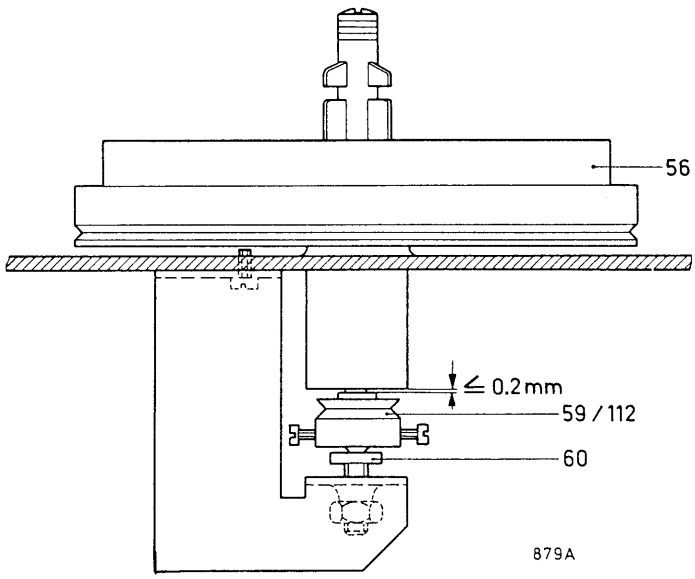



Fig. 11

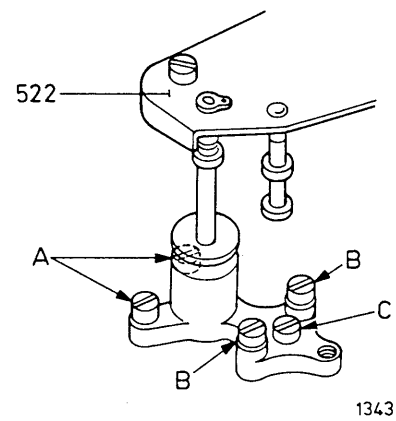



Fig. 12

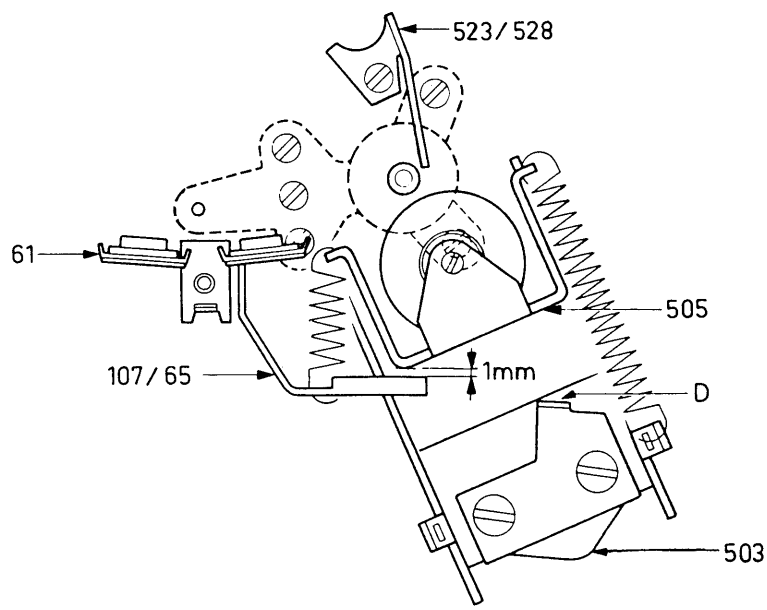



Fig. 13 880AA

3. Solenoids

Remove head covers 120 and 121, button 137 and cover plate 134.

Pressure-roller solenoids (see Fig. 14)

- When the solenoid is energised, the force at the top of the pressure-roller bearing-bracket 505 must be approx. 1300 grammes. This force must occur at the moment that a perceptible clearance arises between the lower bolts on drawrod 73 and bushing 71 in the solenoid armature. The force can be adjusted with the upper bolts 15 on the drawrod.
- When the solenoid is energised, the clearance between bushing 71 and the lower bolts on the drawrod must be just perceptible (0.1 to 0.2 mm).
- End stops 531 must be adjusted so that the clearance between the bottom of the pressure-rollers and a tape which is tensioned around the guide rollers is approx. 1 mm when the solenoids are de-energised (see Fig. 15).
- The clearance between the control bracket for the head switching 74 and 75, and the ring 72 on the drawrod should be approx. 0.2 mm when the solenoid is energised.

Centre-pin solenoid

The first three procedures for adjusting the pressure-roller solenoid also apply to the centre-pin solenoid. The force at the top of the bracket 518 should be approx. 300 grammes.

Brake solenoid and brakes (see Fig. 17)

- When both brake shoes are applied, the two brake brackets 82 and 90 must be in parallel. Adjust by bending the brackets. Check that the brackets do not touch each other after they have been bent.
- When the two brake shoes are positioned against the turntables, cams A and B should be bent so that they are positioned in the middle of the recesses.
- When the solenoid is energised, the clearance between the brake shoes and the turntables must be 0.5 to 1 mm. This can be adjusted by means of the upper nut 15 on drawrod 86.
- When the solenoid is de-energised and the brake shoes have been reversed, end stop 531 must be positioned so that the clearance at the top of drawrod 86 in the recesses of the brake bracket is approx. 0.5 mm.
- Check the braking force of the left-hand and right-hand reel disc as stated in Fig. 16; this force must be about 1000 grammes (force x radius of wound tape). Adjustment is possible by shortening or stretching the springs 80 in Fig. 17.

4. "Cueing" switches (see Fig. 18)

Remove head covers 120 and 121, button 137 and cover plate 134.

- Bend connecting rod 512 so that the clearance between the plastic brackets 511 and 513 and the solenoid armatures is the same.
- Adjust the clearance between the plastic brackets and the solenoid armatures to 1-2 mm with the aid of end stop 515.
- Bend the end stop for the cueing switch (D in Fig. 13) so that the clearance between the pressure-roller and capstan is approx. 2 mm when the cueing button is depressed.
- Move mounting bracket 524 of cueing switches SK703 and SK704 so that both pins touch the top of the plastic bracket 513 when the cueing buttons are depressed.
- Bend bracket 524 so that switches SK703 and SK704 are operated when the cueing buttons are depressed.

5. Adjusting the tape tension (see Fig. 19)

Remove head covers 120 and 121, button 137, cover plate 134 and rear panel 115.

- The clearance between the contact points of SK706 and SK707 must be approx. 0.5 mm.
- The clearance between the cam of the tape tension comparator and the centre contact of the switch must be 0.1 to 0.2 mm in the rest position. Adjust by bending bracket 516.
- The force on the pin of the tape tension comparator must be approx. 20 grammes when the contacts just open. Adjust by hooking the tension spring into another hole (higher: force increases; lower: force decreases).
- Adjust the motor current of the left as well as the right winding motor to 150 mA (= 75 mV across resistors R708// R709 and R706//R707 on the mounting strips on either side of the winding motors). For this, connect the meter to the resistors, depress button " ◁ LEFT" or "RIGHT ▷" and block the relevant reel disc by hand. When the meter indication is stable, the motor current may be corrected, if necessary, with potentiometer R9 on the tape tension units (lower unit for left winding motor; upper unit for right winding motor).
- Adjust the belt dampers so that they just touch the belts.

6. Capstan motor

Remove rear panel 115 and remove the bracket with capstan motor 533.

- Adjust the height of pulley 111 so that the core of head K7 and the magnet ring on the pulley are flush.
- The clearance between the magnet ring and head must be approx. 0.1 mm. This can be adjusted by loosening the fixing screws of the head and moving the head.

7. Capstans (see Fig. 20)

Remove head covers 120 and 121 and rear panel 115.

- Adjust lower pivot bearing 60 so that drive belt 93 runs in parallel with the mounting plate. When the recorder is in the vertical position, the flywheels must be clear of the bearing bushes.
- The upper pivot bearings 105 must spring against the capstans. When the recorder is in the vertical position, there must be no play between the bearing and capstan.
- The play between the bearing bush and the oil seal must be approx. 1 mm.

8. Speed adjustment (see Fig. 21)

- Remove the amplifier unit from the recorder.
- Insert a test tape with a frequency of 3150 Hz, recorded at 4.75, 9.5 or 19 cm/sec, depending on the speed to be adjusted.
- Connect the wow and flutter meter to BU2 TAPE IN/OUT 3/5.
- Adjust the speed with one of the preset potentiometers on unit P10. The potentiometers can be adjusted with an alignment tool through one of the openings in the heatsink of the output amplifier.

Attention
The speed can also be adjusted with the aid of a stroboscope.
- Place the stroboscope next to the recorder and feed the tape around the roller.
- Set the speed selector to 9.5 cm/sec.
- Adjust the correct speed with potentiometer R14.

After adjusting the speed, wow and flutter must be
≤ 0.35 % at 4.75 cm/sec
≤ 0.2 % at 9.5 cm/sec
≤ 0.15 % at 19 cm/sec

MAINTENANCE

It is recommended to clean and lubricate the recorder at regular intervals. The following parts may be cleaned with e.g. alcohol:
tape guides
erase, recording and playback heads
drive belts
capstans
pressure rollers
grooves in pulleys, flywheels and reel discs
brake shoes.
The pressure felts for the heads may be cleaned with a brush.

LUBRICATING INSTRUCTIONS

Shell Clavus 17 - 4822 390 10048

Bearings of flywheels 95, turntables 56, guide rollers 51 and pressure rollers 63.
The part of the capstan which protrudes above the seal must be thoroughly cleaned after lubrication.

Shell Alvania 2 - 4822 389 10001

The various pivots such as those of the pressure felt bracket 65/107, centre pin 78, pressure-roller bracket 506, brake brackets 82/90 etc., the pivot bearings of the reel discs and flywheels 60, the various contact faces such as those between drawrod 83/73 and pressure-roller brackets 506.

MECHANICAL ADJUSTMENTS

Required tools and test equipment:
. set of feeler gauges 0.1 ... 2 mm
. spring-pressure gauge, 30 g
. spring-pressure gauge, 1500 g
. head alignment jig, code number 4822 403 50686
. test tape 13 kHz - 1 kHz, code number 4822 397 30014
. test tape
  3150 Hz, 4.75 cm/sec., code number 8222 305 11170
  3150 Hz, 9.5 cm/sec., code number 8222 305 11190
  3150 Hz, 19 cm/sec., code number 8222 305 11150
. stroboscope, 50 Hz, 4822 395 90001
  60 Hz, 4822 395 90002
. "wow and flutter" meter, e.g. Bruno Woelke, type ME104

1. Adjusting the recording, playback and erase head

Remove head covers 120 and 121.

Coarse adjustment (see Fig. 10)

- Remove head assembly 522.
- With the aid of the gauge and screws A, B and C adjust the heads so that:
  . the top of the upper cores of the right-hand recording and playback heads (K1 and K2) are flush with the top of the gauge.
  . the underside of the lower cores of the left-hand recording and playback heads (K4 and K5) is flush with the underside of the gauge.
  . the gauge can move freely between the guide pins of the erase heads (K3 and K6) and tape guides 101.
  . the front of the heads is perpendicular to the mounting plate.

Fine adjustment (with test tape 13 kHz - 1 kHz)

- Set the speed selector to position "19" and the track selector to position "1-4".
- Adjust the height of the right-hand playback head (K2) by turning screw B until the 1 kHz signal is just audible above the noise.
- Set the speed selector to position "9.5".
- Adjust the azimuth of the right-hand playback head (K2) by turning screw C until the reproduction of the 13 kHz signal is optimum. If desired, this adjustment can be checked with an oscilloscope connected to BU5 MONITOR 3/5.
- The left playback head (K5) is adjusted in the same way. Do not forget to reverse the test tape and to set the recorder to tape transport to the left!

Phase adjustment

First of all, the playback head should be adjusted so that the upper and lower core gaps are in line. Subsequently, the adjustment of the recording head should be adapted to this.

Adjusting the playback head (with test tape 13 kHz - 1 kHz)

- Set the speed selector to "9.5" and the track selector to position "ST"; tape transport to the right.
- Connect a double beam oscilloscope to BU5 MONITOR (e.g. output left channel (3) to Ya input and output right channel (5) to the Yb input).
- Adjust the right-hand playback head (K2) by turning screw C until both signals are in phase and have max. amplitude.
- Adjust the left playback head (K5) in the same way. Do not forget to reverse the test tape and to change the tape transport direction to the left!

Attention
It may occur that the amplitude of the two signals is not the same. This is caused by dirt on the heads or head wear, poor solder joints etc.

Adjusting the recording head

- Insert a normal tape (preferably a high-output tape) and apply a signal of e.g. 10 kHz to the inputs of both channels (e.g. to socket BU2 TAPE IN/OUT 3/5).
- Set the recorder to position recording, the speed selector to "19" and the track selector to "A".
- Connect a double beam oscilloscope to BU5 MONITOR (e.g. output left channel (3) to $Y_A$ input and output right channel (5) to the $Y_B$ input).
- Adjust the right-hand recording head (K1) by turning screw C until both signals are in phase.
- Adjust the left recording head (K4) in the same way. The tape should now run to the left.

Attention
- Coarse adjustment of the heads is also possible with a normal tape. However, this should be done only if both tape guides 101 are perpendicular.
- To replace one head, unscrew it from the base plate; this will not affect the adjustment.
- During all adjustments check that springs 99 are not fully compressed.
- After the complete adjustment procedure, set screws A, B and C should be lock-painted.
- Erase heads K3 and K6 are supplied in one version only. By fitting the fixing nut either in the upper or lower recess at the back of the erase head, it can be rendered suitable for mounting to the left or right of the centre pin.

2. Tape path

Remove head covers 120 and 121, button 137, cover plate 134 and rear panel 115.

Pulley of winding motors

- The height of the pulley 55 on the shaft must be adjusted so that the groove is at the same height as the groove of the reel disc.

Reel discs (see Fig. 11)

- The height of the reel disc must be adjusted so that the tape runs in the middle of the reel. Adjust with pivot bearing 60.
- The axial play must be adjusted to $\leq$ 0.2 mm by moving pulley 59 and ring 112 respectively.

Guide rollers

- The axial play of the guide rollers 51 must be adjusted to $\leq$ 0.2 mm with the aid of the circlip.

Attention
The height of the guide rollers have been factory-adjusted with the aid of shims. When replacing the roller, the height must be checked with the aid of the head alignment jig.

Capstan bearings (see Fig. 12)

- Block the relay of the centre pin, so that this relay cannot be energised.
- Remove the head assy 522.
- Thread a normal tape.
- Loosen the screws A, B and C half a turn.
- Adjust screws B so that the tape runs straight between the capstan and pressure-roller.
- Tighten screw C, so that the adjustment is not distrubed.
- Tighten the screws A and B.

Pressure-rollers (see Fig. 13)

- Position the bearing bracket of pressure-roller 503 so that the roller presses flatly against the capstan without any clearance at the top or bottom.

Centre pin

- Bend the stop cam on bracket 527 so that the centre pin is perpendicular to the mounting plate when the relay is energised.

Spacer brackets (see Fig. 13)

- Bend brackets 523 or 528 so that the clearance to the capstan is approx. 1 mm.

Pressure felts (see Fig. 13)

- The pressure felts must seat accurately against the heads.
- The clearance between the bearing bracket of pressure roller 505 and the cam of pressure-felt bracket 107 or 65 must be approx. 1 mm when the relay is energised.

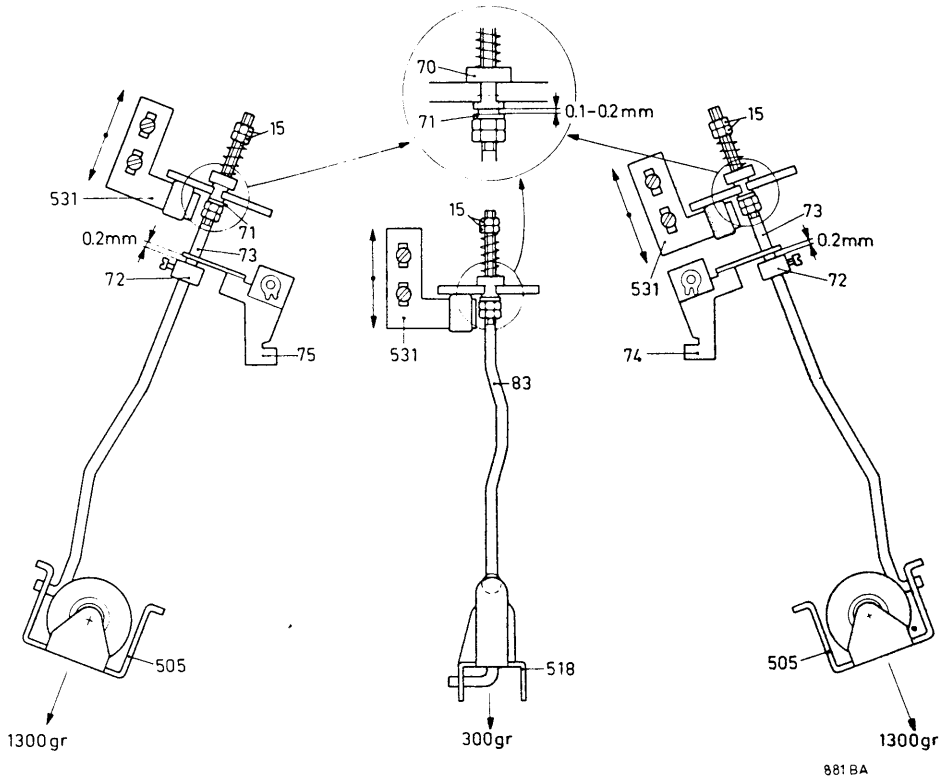



Fig. 14

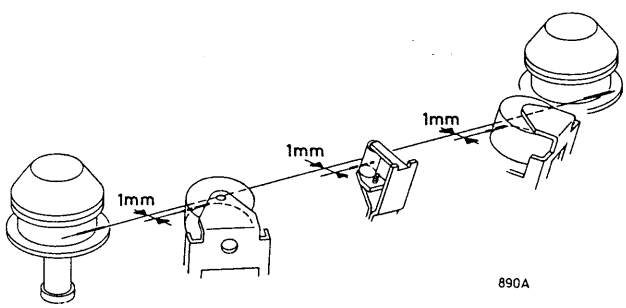



Fig. 15

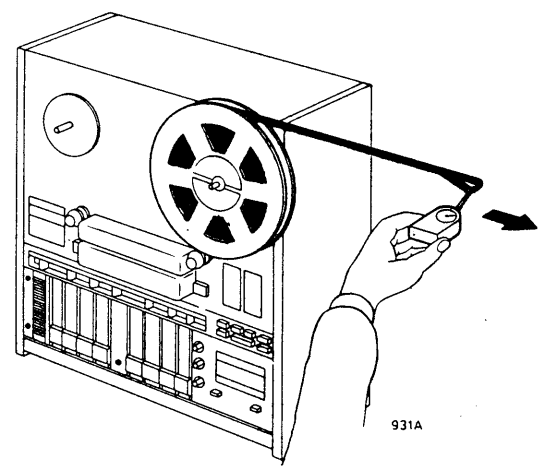



Fig. 16

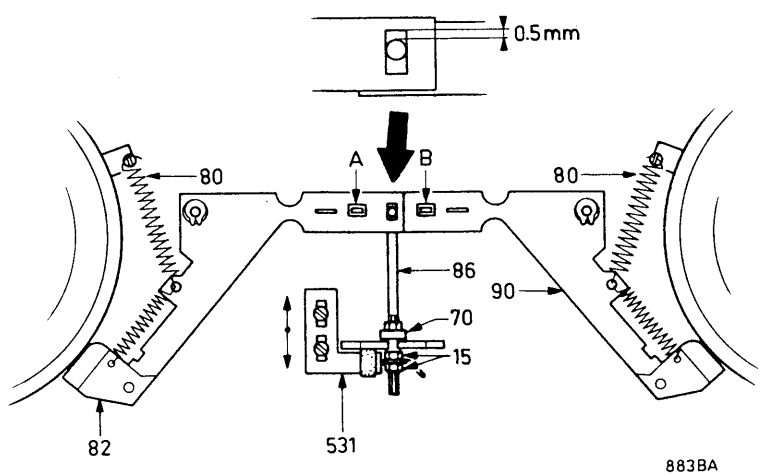



Fig. 17

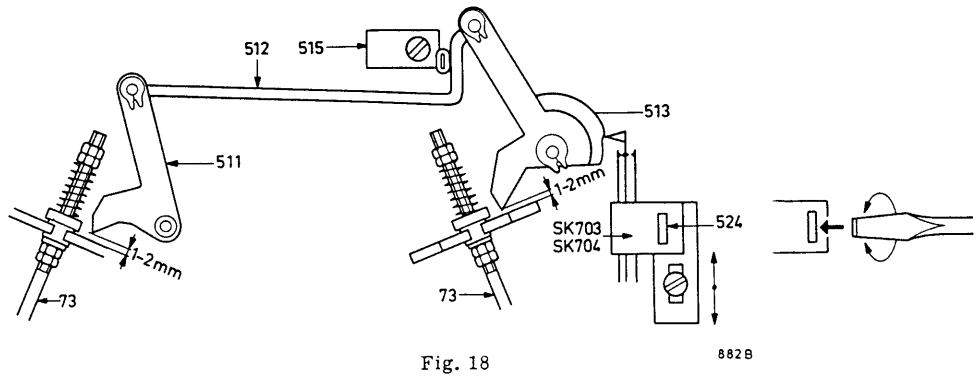



Fig. 18

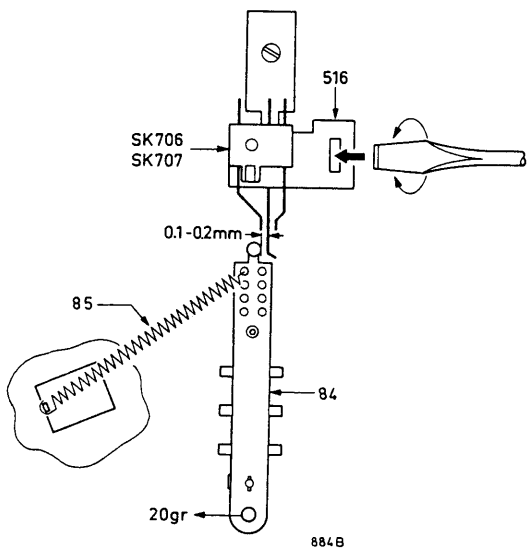



Fig. 19

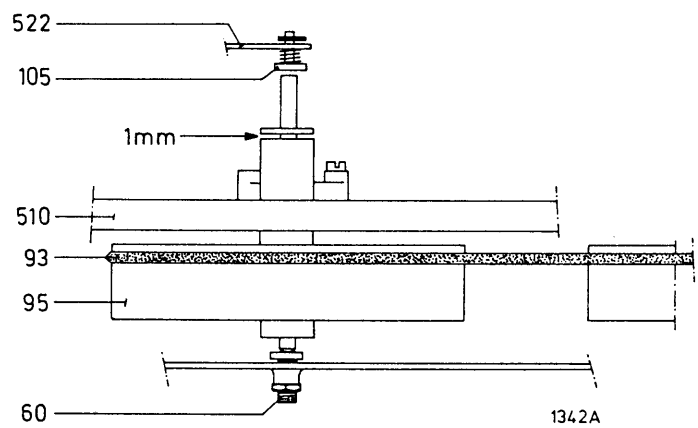



Fig. 20

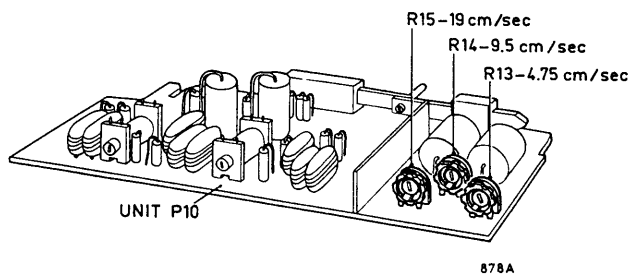



Fig. 21

LIST OF MECHANICAL PARTS

I. Tape transport

| | | |
|---|---|---|
| 1 | Screw M2x5 | 4822 502 10679 |
| 2 | Screw M3x4 | 4822 502 11189 |
| 3 | Washer | 4822 532 50725 |
| 4 | Screw M3x8 | 4822 502 11053 |
| 5 | Nut M5 | 4822 505 10327 |
| 6 | Screw M4x6 | 4822 502 11065 |
| 7 | Retaining ring 3 dia. | 4822 530 70115 |
| 8 | Washer 7 x 3.2 x 0.3 | 4822 532 50298 |
| 9 | Washer 4.3 Ø | 4822 532 10333 |
| 10 | Washer | 4822 532 50268 |
| 11 | Screw M3x6 | 4822 502 11064 |
| 12 | Screw M4x12 | 4822 502 10694 |
| 13 | Screw M3x10 | 4822 502 10689 |
| 14 | Washer 3 dia. | 4822 530 80082 |
| 15 | Nut M3 | 4822 505 10325 |
| 16 | Screw M2.5x4 | 4822 502 10812 |
| 18 | Selftap screw 4.2 x 25 | 4822 502 30101 |
| 19 | Lock washer | 4822 530 80083 |
| 20 | Screw M4x10 | 4822 502 11066 |
| 22 | Screw M2,5x10 | 4822 502 10814 |
| 23 | Screw M2x3 | 4822 502 10908 |
| 24 | Washer 4 dia. | 4822 530 70116 |
| 25 | Washer 3.2 dia. | 4822 532 10332 |
| 27 | Curved washer | 4822 530 80069 |
| 28 | Screw M3x15 | 4822 502 10691 |
| 30 | Screw M2x4 | 4822 502 11059 |
| 31 | Washer | 4822 492 61711 |
| 32 | Screw M3x20 | 4822 502 11004 |
| 33 | Distant bush 3.1x16 | 4822 532 20607 |
| 34 | Screw M2x6 | 4822 502 10745 |
| 36 | Screw M2.5x6 | 4822 502 10813 |
| 37 | Washer | 4822 532 50928 |
| 38 | Spring washer | 4822 530 80144 |
| 51 | Guide roller | 4822 528 70232 |
| 52 | Screw of reel disc | 4822 502 11218 |
| 53 | Catch piece of reel disc | 4822 532 20578 |
| 54 | Compression spring | 4822 492 50923 |
| 55 | Pulley | 4822 528 80477 |
| 56 | Reel disc assy | 4822 528 10251 |
| 57 | Drive belt | 4822 358 30127 |
| 58 | Belt damper | 4822 479 30049 |
| 59 | Pulley | 4822 528 80478 |
| 60 | Hexagon nut | 4822 502 10765 |
| 61 | Pressure felt assy | 4822 403 50638 |
| 62 | Set screw | 4822 502 10522 |
| 63 | Pressure roller | 4822 528 70018 |
| 64 | Tension spring | 4822 492 30934 |
| 65 | Pressure felt assy | 4822 403 50615 |
| 66 | Bearing bracket assy | 4822 403 50613 |
| 67 | Tension spring | 4822 492 30681 |
| 68 | Tension spring | 4822 492 30933 |
| 69 | Compression spring | 4822 492 50923 |
| 70 | Bush | 4822 532 30256 |
| 71 | Tubular rivet | 4822 532 20618 |
| 72 | Washer | 4822 532 30255 |
| 73 | Rod | 4822 535 80491 |
| 74 | Bracket | 4822 403 50627 |
| 75 | Bracket | 4822 403 50628 |
| 76 | Centre pin | 4822 535 80529 |
| 77 | Counter switch unit assy | 4822 349 50058 |
| 78 | Bracket | 4822 403 40042 |
| 79 | Driving belt | 4822 358 30045 |
| 81 | Tension spring | 4822 492 30935 |
| 82 | Brake bracket left | 4822 403 10119 |
| 83 | Rod | 4822 535 80492 |
| 84 | Tape tension comparator | 4822 403 50629 |
| 85 | Tension spring | 4822 492 30936 |
| 86 | Rod | 4822 535 80493 |
| 87 | Washer | 4822 532 50716 |
| 88 | Capstan bearing | 4822 520 10311 |
| 89 | Compression spring | 4822 492 50152 |
| 90 | Brake bracket right | 4822 403 10121 |
| 91 | Tension spring | 4822 492 30678 |
| 92 | Bearing bracket assy | 4822 403 50611 |
| 93 | Drive belt | 4822 358 30163 |
| 94 | Belt damper | 4822 479 30051 |
| 95 | Flywheel | 4822 528 60069 |
| 96 | Grub screw M3x10 | 4822 535 80528 |
| 97 | Screw | 4822 502 11217 |
| 98 | Nut | 4822 505 10408 |
| 99 | Compression spring | 4822 492 50924 |
| 100 | Washer | 4822 532 10657 |
| 101 | Bush | 4822 532 20433 |
| 102 | Washer | 4822 528 70246 |
| 103 | Hexagon nut M1.6 | 4822 505 10514 |
| 104 | Bearing | 4822 535 70468 |
| 105 | Compression spring | 4822 492 50925 |
| 106 | Screw | 4822 502 11216 |
| 107 | Splicing device | 4822 403 50639 |
| 108 | Pressure felt assy | 4822 403 50614 |
| 109 | Bearing bracket assy | 4822 403 50612 |
| 110 | Grommet | 4822 325 60029 |
| 111 | Pulley | 4822 528 80476 |
| 112 | Ring | 4822 532 30253 |

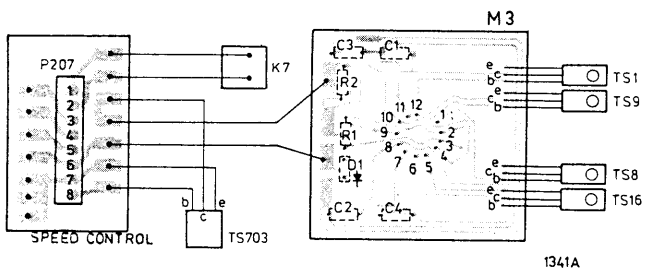
II. Cabinet and amplifier unit

| | | |
|---|---|---|
| 7 | Retaining ring 3 dia. | 4822 530 70115 |
| 9 | Washer 4.3 dia. | 4822 532 10333 |
| 16 | Screw M2.5x4 | 4822 502 10812 |
| 39 | Screw | 4822 502 10053 |
| 40 | Selftap screw | 4822 502 30048 |
| 41 | Wood screw 2.2x15 | 4822 528 70246 |
| 42 | Nut M4 | 4822 505 10262 |
| 43 | Screw M4x22 | 4822 502 11161 |
| 44 | Selftap screw | 4822 502 30091 |
| 46 | Screw M1.7x4 | 4822 502 10948 |
| 47 | Screw M4x8 | 4822 502 10693 |
| 48 | Selftap screw | 4822 502 30081 |
| 49 | Washer | 4822 532 10479 |
| 113 | Lid | 4822 443 60368 |
| 114 | Bolt | 4822 500 10181 |
| 115 | Rear panel | 4822 443 50193 |
| 116 | Foot | 4822 462 40017 |
| 117 | Tubular rivet | 4822 535 90914 |
| 118 | Support | 4822 532 20063 |
| 119 | Handle assy | 4822 498 40314 |
| 120 | Head cover | 4822 443 60366 |
| 121 | Head cover | 4822 443 60367 |
| 122 | Button assy | 4822 410 30061 |
| 123 | Button assy | 4822 276 10447 |
| 124 | Plate | 4822 459 80053 |
| 125 | Plate (foot) | 4822 443 60365 |
| 126 | Catch piece | 4822 403 50683 |
| 127 | Strip | 4822 403 50624 |
| 129 | Slider | 4822 403 50625 |
| 130 | Ornamental cap | 4822 462 50178 |
| 131 | Hinge | 4822 417 10295 |
| 132 | Spring | 4822 492 40502 |
| 133 | Housing assy | 4822 443 40069 |
| 134 | Cover plate assy | 4822 443 30214 |
| 135 | Washer | 4822 532 50924 |
| 136 | Cover | 4822 443 20071 |
| 137 | Knob | 4822 411 50268 |
| 138 | Ornamental screw | 4822 502 11215 |
| 139 | Meter right | 4822 347 10071 |
| 141 | Meter left | 4822 347 10069 |
| 142 | Tension spring | 4822 492 30937 |
| 143 | Bracket | 4822 403 50626 |
| 144 | Button | 4822 410 21244 |
| 145 | Cover | 4822 459 40261 |
| 146 | Bracket assy (light channel) | 4822 403 50616 |
| 147 | Cover | 4822 459 80038 |
| 148 | Bracket assy (light channel) | 4822 403 50617 |
| 149 | Cover | 4822 459 80037 |
| 150 | Full dog point screw | 4822 502 11259 |
| 151 | Ball 5/32" | 4822 520 40024 |
| 152 | Leaf spring | 4822 492 61812 |
| 153 | Catch | 4822 535 70419 |
| 154 | Bolt | 4822 535 90912 |
| 155 | Compression spring | 4822 492 50927 |
| 156 | Bracket | 4822 403 50682 |
| 157 | "RIGHT ▷" button assy | 4822 410 21174 |
| 158 | "PAUSE" button assy | 4822 410 21173 |
| 159 | "WIND ▷▷ " button assy | 4822 410 21176 |
| 160 | "REC" button assy | 4822 410 21172 |
| 161 | "STOP" button assy | 4822 410 21169 |
| 162 | "◁ LEFT" button assy | 4822 410 21171 |
| 163 | "◁◁ WIND" button assy | 4822 410 21175 |
| 164 | Cover (clock) | 4822 459 80037 |
| 165 | Clock assy | 4822 282 10096 |
| 166 | Ornamental plate | 4822 454 20211 |
| 168 | Button | 4822 410 21243 |
| 169 | Ornamental plate (TREBLE) | 4822 454 20208 |
| 170 | Ornamental plate (BASS) | 4822 454 20209 |
| 171 | Ornamental plate (BALANCE) | 4822 454 20207 |
| 172 | Ornamental plate (VOLUME) | 4822 454 20206 |
| 173 | Ornamental plate (PHONO) | 4822 454 20204 |
| 174 | Ornamental plate (MICRO RIGHT) | 4822 454 20203 |
| 175 | Ornamental plate (MICRO LEFT) | 4822 454 20202 |
| 176 | Cover | 4822 443 60369 |
| 177 | Socket plate assy | 4822 267 20131 |
| 178 | Screw | 4822 502 10856 |
| 179 | Screw M3x8 | 4822 502 11074 |
| 180 | Cover | 4822 460 20067 |
| 181 | Plate | 4822 454 20212 |
| 182 | Isolator | 4822 325 10057 |
| 183 | Spring | 4822 492 61712 |
| 184 | Leaf spring | 4822 492 61709 |
| 185 | Slider | 4822 278 30091 |
| 187 | Screw M3x4 | 4822 502 10663 |
| 188 | Worm | 4822 522 31099 |
| 189 | Ornamental plate (ECHO) | 4822 454 20205 |

LIST OF ELECTRICAL PARTS

I. Control part

| | | |
|---|---|---|
| P201 | Reset/automatic reverse unit | 4822 218 30063 |
| P202 | Motor stop unit | 4822 218 30069 |
| P203, 204 | Tape tension unit | 4822 218 30067 |
| P205, 206 | Flip-flop unit | 4822 218 30068 |
| P207 | Speed control unit | 4822 218 30062 |
| P10 | Speed selector/pre-emphasis unit | 4822 218 30064 |
| SK6 | Slide switch (MP-NOR-ECH-AMP) | 4822 277 30497 |
| SK8 | Slide switch (NOR-REV) | 4822 277 30498 |
| SK9 | Slide switch (FAST-MED-SLOW) | 4822 277 30499 |
| SK30 | Slide switch (head switch) | 4822 277 60118 |
| SK701 | Push button switch (AUTOSTOP) | 4822 276 10448 |
| | Button for SK701 | 4822 276 10447 |
| SK705 | Switch (reel-size selector) | 4822 273 40283 |
| SK706, 707 | Switch (tape tension) | 4822 278 90035 |
| SK712 | Push button switch (TIMER) | 4822 276 10448 |
| | Button for SK712 | 4822 276 10447 |
| all diodes except D225 D242 t/m D245, D248 D249, D263 | BA217 | 4822 130 30703 |
| D225 | Zener diode BZX79/C16 | 4822 130 30438 |
| D264 | Diode OF223 | 4822 130 30791 |
| D255, 256 | Diode BAX16 | 4822 130 30273 |
| D257 | Zener diode BZX79/C4V7 | 4822 130 30773 |
| D269 | Stabistor BZX75/C2V1 | 4822 130 30789 |
| D279, 280 | Zener diode BZX79/C30 | 4822 130 30701 |
| BU201 | Socket 10p (REMOTE) | 4822 267 50149 |
| RE1 | Relay | 4822 280 60177 |
| RE201, 202, 203, 204 | Solenoid | 4822 280 70134 |
| TS201 | Transistor 2SC931 | 4822 130 40799 |
| TS701, 702 | Transistor 2N6107 | 4822 130 40903 |
| TS703 | Transistor BD135 | 4822 130 40645 |
| M1, 2 | Winding motor | 4822 361 20091 |
| M3 | Capstan motor | 4822 361 20092 |
| K7 | Pulse head | 4822 249 20025 |
| L701, 702, 703, 704 | Coil | 4822 158 10224 |
| LA601, 602 603, 604 605, 606 | Lamp 19 V - 50 mA (button illumination) | 4822 134 40078 |
| | Socket for functional unit, 14p | 4822 267 50151 |
| | Socket for functional unit, 8p | 4822 267 50156 |



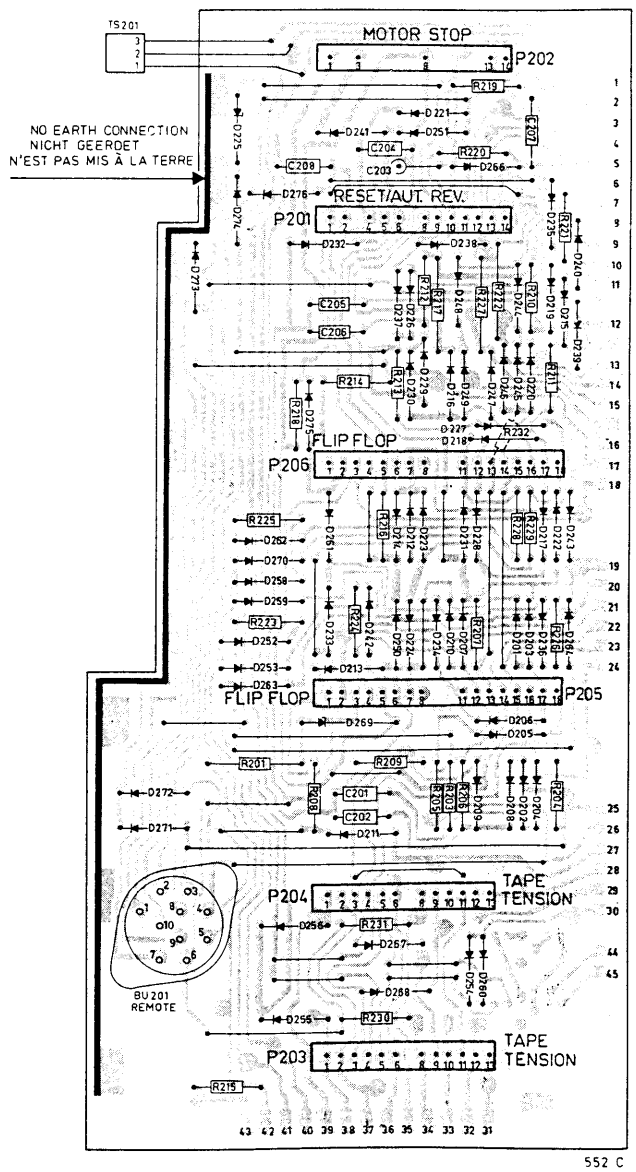




Fig. 24

CS32941
CS32895a

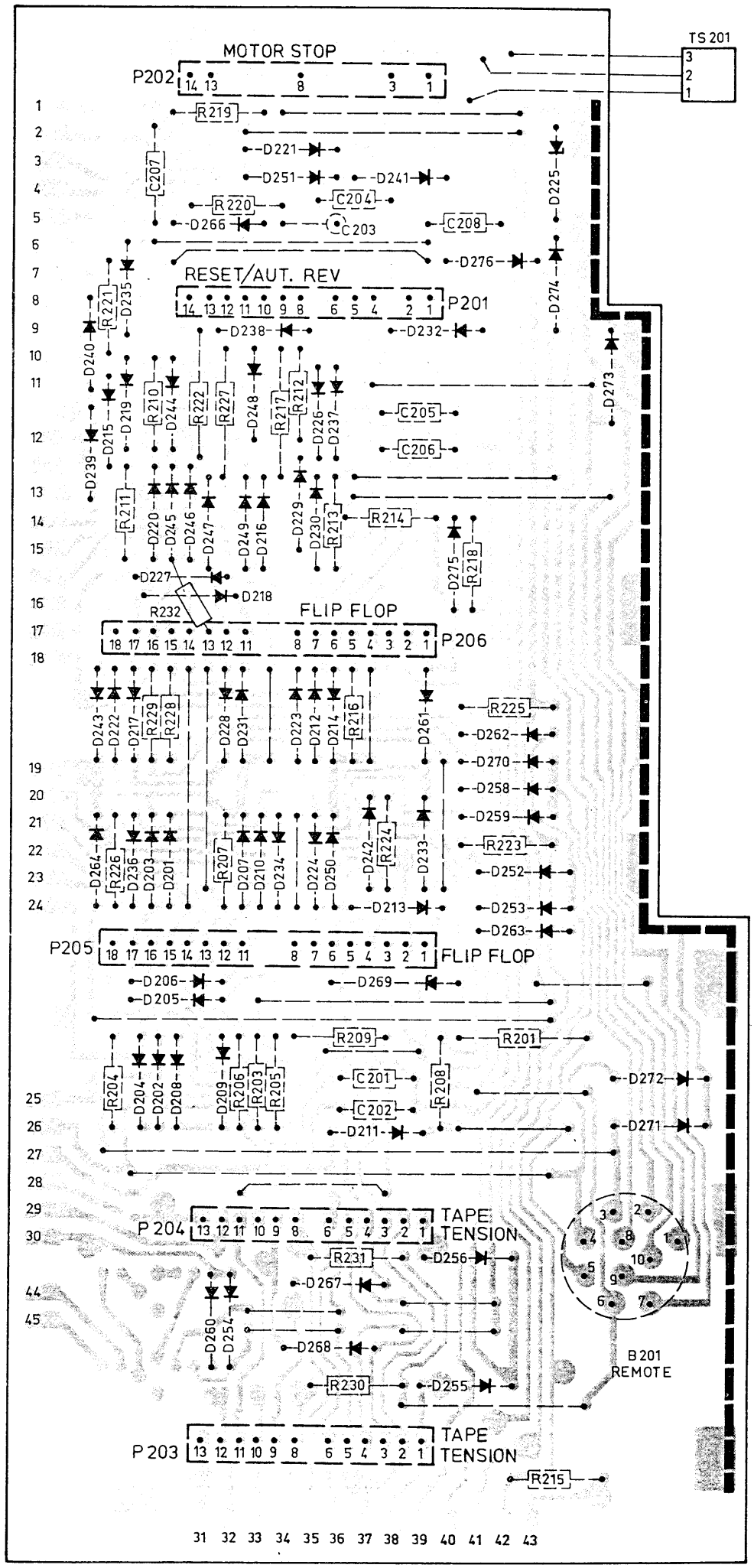

MOTOR STOP
P202
TS 201
RESET/AUT. REV
P201
FLIP FLOP
P206
P205
FLIP FLOP
P204
TAPE TENSION
B201 REMOTE
P203
TAPE TENSION
1339C

Fig. 29

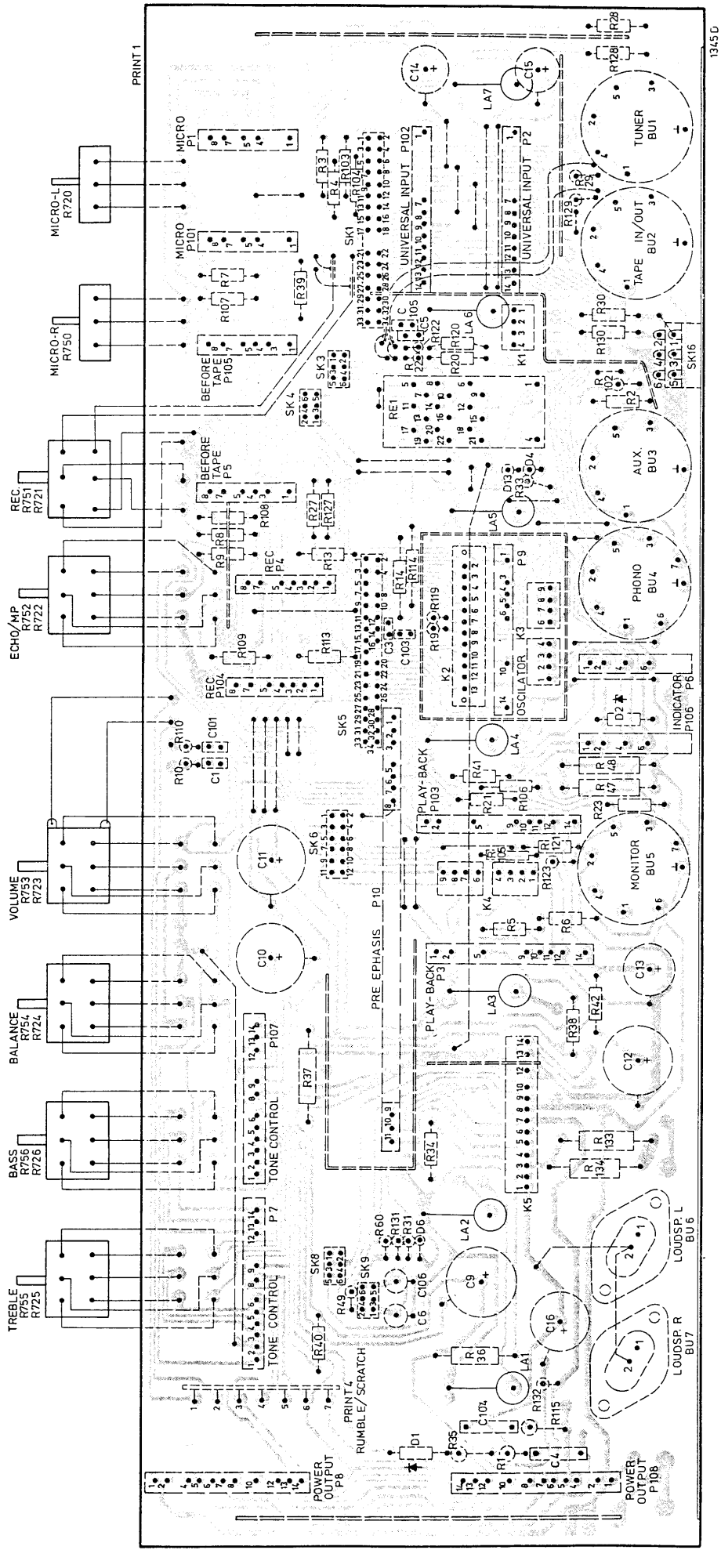

PRINT 1
1345 D
MICRO-L R720
MICRO-R R750
REC R751 R721
ECHO/MP R752 R722
VOLUME R753 R723
BALANCE R754 R724
BASS R756 R726
TREBLE R755 R725
MICRO P1
MICRO P101
BEFORE TAPE P105
BEFORE TAPE P5
REC P4
REC P104
PLAY-BACK P103
PLAY-BACK P3
PRE EPHASIS P10
TONE CONTROL P107
TONE CONTROL P7
RUMBLE/SCRATCH PRINT 4
POWER OUTPUT P8
POWER OUTPUT P108
UNIVERSAL INPUT P102
UNIVERSAL INPUT P2
OSCILLATOR K3
INDICATOR P106 P6
TUNER BU1
TAPE IN/OUT BU2
AUX. BU3
PHONO BU4
MONITOR BU5
LOUDSP. L BU 6
LOUDSP. R BU7
SK16

Fig. 30

## II. TAPE LOOPS DURING RECORDING/PLAYBACK

. Check the tape transport functions of the apparatus. Check in particular that the tape is tantened if the set is switched on and if the centre pin and the pressure rollers are attracted.
. Check the motor current of the two winding motors (M1 and M2). See Mechanical adjustments "Adjusting the tape tension".

1. Motor currents are not correct → Adjust
   - Motor current of M1 (left) cannot be adjusted exactly → Replace P203 or TS701 (readjust motor current)
   - Motor current M2 (right) cannot be adjusted exactly → Replace P204 or TS702 (readjust motor current)
   - The two motor currents can be adjusted properly
2. Motor currents are correct → Replace P203 or P204 (Adjust motor current)

. The tape is still looping → . Remove the tape
. Recorder in position "RIGHT ▷"
. Push the left-hand tape tension comparator (SK706) in the direction of the tape guide.
Left-hand reel disc does not stop within about 2 seconds → Check SK706, D262 or R228.
. Push the right-hand tape tension comparator (SK707) in the direction of the tape guide.
Right-hand reel disc does not stop within about 5 seconds → Check SK707, D258 or R225
. Recorder in position " ◁ LEFT".
. Push the right-hand tape tension comparator (SK707) in the direction of the tape guide.
Right-hand reel disc does not stop within about 2 seconds → Check D270 or R229
. Push the left-hand tape tension comparator (SK706) in the direction of the tape guide.
Left-hand reel disc does not stop within about 5 seconds → Check D252 or R223

### TAPE LOOPS DURING FAST WINDING

. Check the braking forces, see under "Mechanical Adjustments" Brake solenoid and brakes.
. Check the brake solenoid for attracting and repelling properly(in particular zener diode D 257).
. Recorder in position "WIND ▷▷ "
. Push the left-hand tape tension comparator (SK706) in the direction of the tape guide.
Left-hand reel disc does not stop within about 2 seconds → Check D253 or R224
. Recorder in position " ◁◁ WIND"
. Push the right-hand tape tension comparator (SK707) in the direction of the tape guide.
Right-hand reel disc does not stop within about 2 seconds → Check D259 or R226

## III. SPECIAL FAULTS

. Recorder does not start after a certain command when the tape contact is switched on →
- ▷ → D274
- ◁ → D273
- ▷▷ → D272
- ◁◁ → D271
- ▷+◁+▷▷+◁◁ → P201 or D225

. When two keys are depressed at the same time both commands are carried out →
- ▷+◁◁ / ◁+◁◁ → D203
- ▷+▷▷ / ◁+▷▷ → D207
- ▷+▷▷ / ▷+◁◁ → D231
- ◁+▷▷ / ◁+◁◁ → D222

. Recorder stops after a certain key has been depressed repeatedly →
- ▷ → D230
- ◁ → D220
- ▷▷ → D209
- ◁◁ → D204

. Automatic reverse does not operate → P201, SK8, D216, D235, R217, C208

## IV. CHECKING SEQUENCE FOR THE CONTROL SECTION

- The encircled figures in the last column correspond to those stated in the fault finding tree Ⓐ of the control section.
- In order to find your way about in the repair method always begin with the first instruction in the table. After some practice this will take you only a few minutes.
- 10 → NOR
  27 → NOR
  TIMER/AUTOSTOP → off

| | | |
|---|---|---|
| Switching on | Lamps start burning (LA1-LA9)<br>Flywheels start turning (M3 runs)<br>Reel discs make some revolutions when the set is switched on and stop<br>LA604 ( ◁ ) or LA605 ( ▷ ) starts burning at half power<br>The set is now in position Stop | 1 |
| ▷ | Centre pin (RE203) is attracted<br>Right-hand pressure-roller (RE202) is attracted<br>Brake is released (RE204 is attracted)<br>LA605 ( ▷ ) starts burning<br>The two reel discs start rotating | 2 |
| PAUSE | Centre pin (RE203) is still attracted<br>Right-hand pressure-roller (RE202) is released<br>Tape is braked (RE204 is not energised)<br>LA605 ( ▷ ) burns at half power<br>LA603 (PAUSE) starts burning<br>The two reel discs stop | 3 |
| ▷ | Centre pin (RE203) is still attracted<br>Right-hand pressure-roller (RE202) is attracted<br>Brake is released (RE204 is energised)<br>LA605 ( ▷ ) starts burning<br>LA603 (PAUSE) goes out<br>The two reel discs are rotating | 4 |
| PAUSE + REC | Centre pin (RE203) is still attracted<br>Right-hand pressure-roller (RE202) is released<br>Tape is braked (RE204 is not energised)<br>LA605 ( ▷ ) is burning at half power<br>LA603 (PAUSE) and LA606 (REC) burn<br>The two reel discs stop | 5 |
| ▷ | Centre pin (RE203) is still attracted<br>Right-hand pressure-roller (RE202) is released<br>Brake is released (RE204 is energised)<br>LA605 ( ▷ ) and LA606 (REC) burn<br>LA603 (PAUSE) goes out<br>The two reel discs start rotating | 6 |
| STOP | Centre pin (RE203) is released<br>Right-hand pressure-roller (RE202) is released<br>Tape is braked (RE204 is not energised)<br>LA605 ( ▷ ) burns at half power<br>LA606 (REC) goes out<br>Reel discs stop | 7 |
| ◁ | Centre pin (RE203) is attracted<br>Left-hand pressure-roller (RE201) is attracted<br>Brake is released (RE204 is energised)<br>LA604 ( ◁ ) starts burning<br>LA605 ( ▷ ) goes out<br>The two reel discs start rotating | 8 |
| PAUSE | Centre pin (RE203) is still attracted<br>Left-hand pressure-roller (RE201) is released<br>Tape is braked (RE204 is not energised)<br>LA604 ( ◁ ) is burning at half power<br>LA603 (PAUSE) starts burning<br>The two reel discs stop | 9 |
| ◁ | Centre pin (RE203) is still attracted<br>Left-hand pressure-roller (RE201) is attracted<br>Brake is released (RE204 is energised)<br>LA604 ( ◁ ) starts burning<br>LA603 (PAUSE) goes out<br>The two reel discs start rotating | 10 |
| STOP | Centre pin (RE203) is released<br>Left-hand pressure-roller (RE201) is released<br>Tape is braked (RE204 is not energised)<br>LA604 ( ◁ ) is burning at half power<br>The two reel discs stop | 11 |
| ▷▷ | Brake is released (RE204 is energised)<br>LA602 ( ▷▷ ) starts burning<br>LA604 ( ◁ ) is burning at half power<br>Right-hand reel disc is rotating at a very high speed<br>Left-hand reel disc makes some revolutions when set is switched on<br>After about 7 seconds this reel disc starts rotating slowly | 12 |
| ◁◁ | LA602 ( ▷▷ ) goes out<br>LA601 ( ◁◁ ) starts burning<br>LA604 ( ◁ ) is burning at half power<br>Tape is braked (RE204 is not energised)<br>The two reel discs stop<br>Then brake is released (RE204 is energised)<br>Left-hand reel disc is rotating at a very high speed<br>Right-hand reel disc makes some revolutions, when the function is released. After about 7 seconds the right-hand reel disc starts rotating slowly | 13 |
| ▷▷ | LA601 ( ◁◁ ) goes out<br>LA602 ( ▷▷ ) starts burning<br>LA604 ( ◁ ) is burning at half power<br>Tape is braked (RE204 is not energised)<br>The two reel discs stop<br>Then brake is released (RE204 is energised)<br>Right-hand reel disc is rotating at very high speed<br>Left-hand reel disc makes some revolutions, when the function is released.<br>After about 7 seconds the left-hand reel disc starts rotating slowly. | 14 |
| PAUSE + REC | Nothing happens | 15 |
| ◁◁ | LA602 ( ▷▷ ) goes out<br>LA601 ( ◁◁ ) starts burning<br>LA604 ( ◁ ) is burning at half power<br>Tape is braked (RE204 is not energised)<br>The two reel discs stop<br>Then brake is released (RE204 is energised)<br>Left-hand reel disc is rotating at a very high speed<br>Right-hand reel disc makes some revolutions, when the function is released<br>After about 7 seconds the right-hand reel disc starts rotating slowly | 16 |
| PAUSE | Nothing happens | 17 |
| STOP | LA601 ( ◁◁ ) goes out<br>LA604 ( ◁ ) is burning at half power<br>Tape is braked (RE204 is not energised<br>The two reel discs stop | 18 |

# REPAIR METHOD

## General remarks

Apart from fault finding tree Ⓐ (to check the control section) and fault finding tree Ⓑ (to check the amplifier), both present in an envelope at the back of this service manual, this repair method includes:

I. an example
II. tape loops during recording/play-back and fast winding
III. special faults
IV. checking sequence for the control section
V. an explanation of the symbols used in this method

Attention

- Check the control circuit without tape.
  Check the recording/playback printed panel with tape.
- After P203, P204, TS701, TS702, M1 or M2 have been replaced, always readjust the motor current of M1 and M2 respectively.
- All control keys, except for the stop key, are fitted with pilot lamps:
  . if the lamp burns at full power, the function concerned has been adjusted.
  . if lamp LA604 of key " ◁ LEFT" or lamp LA605 of key "RIGHT ▷ " burns at half power, the latest playing direction is indicated; burning at half power does not mean that the function has been switched on. Burning at half power is not mentioned in the repair method any more and is considered to be not burning.
- The symbols or indications underlined mean that an operation has to be carried out with one of the operating controls.

---

- If the repair method refers to a certain component or to a printed panel, not only the component but also connecting leads, print tracks, soldering connections and plug connections to the component/printed panel in question must be checked.
- We suggest that the lower head cover is removed when you want to look at the pressure roller, centre pin etc.
- The repair method does not deal with adjustments. See the adjusting instruction.

---

## I. EXAMPLE

Assume diode D205 has been short-circuited:

1. Remove the tape and set the knobs 34, 10 and 27 as indicated.
2. Check that M3 (capstan motor) runs.
   Result: M3 runs.
   There are now various possibilities when the recorder is being switched on.
3. ▷▷ → Fast winding right is switched on
4. ◁◁ → Fast winding left is switched on
5. ▷ → Playback right is switched on
6. ◁ → Playback left is switched on
7. Stop This is the normal situation
8. ▷+▷▷ → Playback and fast winding right are switched on

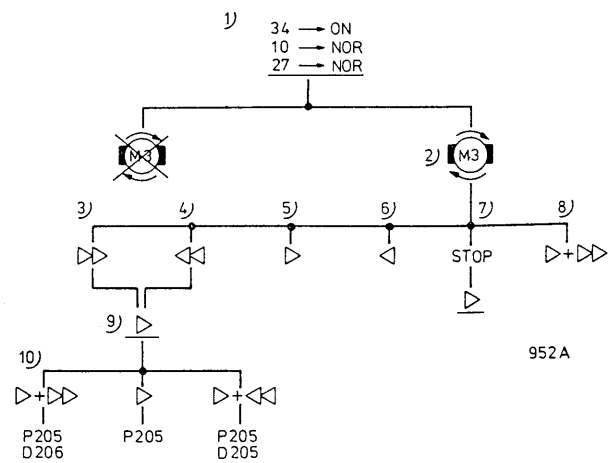
etc.

In case of this fault phenomenon 4) will reveal.
This may have various causes (for example P205, D205 or D206).
To distinguish between these parts, we continue with:

9. ▷ → Depress the key "RIGHT ▷ "

The consequence may be:

10. ▷ + ▷▷ → Playback right + fast winding right
11. ▷ → Playback right
12. ▷ + ◁◁ → Playback right + fast winding left. This means that for example, D205 may be defective.



◁ + REC

Centre pin (RE203) is attracted
Left-hand pressure-roller (RE201) is attracted
Brake is released (RE204 is energised) (19)
LA604 ( ◁ ) and LA606 (REC) start burning
The two reel discs start rotating

STOP

Centre pin (RE203) is released.
Left-hand pressure-roller (RE201) is released
Tape is braked (RE204 is not energised) (20)
LA604 ( ◁ ) is burning at half power
LA606 (REC) goes out
The two reel discs stop

▷ + REC

Centre pin (RE203) is attracted
Right-hand pressure-roller (RE202) is attracted
Brake is released (RE204 is energised) (21)
LA604 ( ◁ ) goes out
LA605 ( ▷ ) and LA606 (REC) start burning
The two reel discs start rotating

▷▷

Centre pin (RE203) is released
Right-hand pressure-roller (RE202) is released
Tape is braked (RE204 is not energised)
LA605 ( ▷ ) is burning at half power
LA606 (REC) goes out
LA602 ( ▷▷ ) starts burning
The two reel discs stop
Then brake is released (RE204 is energised) (22)
Right-hand reel disc is rotating at a very high speed
Left-hand reel disc makes some revolutions, when the function is released
After about 7 seconds the left-hand reel disc starts rotating slowly.

STOP

LA602 ( ▷▷ ) goes out
LA605 ( ▷ ) is burning at half power
Tape is braked (RE204 is not energised) (23)
The two reel discs stop.

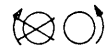
## V. EXPLANATION OF THE SYMBOLS

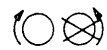
Motor M... runs

Motor M... does not run

The two reel discs turn immediately after the command has been given

Reel discs do not rotate


Left-hand reel disc does not rotate


Right-hand reel disc does not rotate

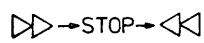
Relay is energised

Relay is not energised

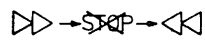
Lamp does not burn

Fit a short-circuit lead

Remove the short-circuit load



Recorder stops between two commands



Recorder does not stop between two commands

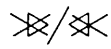

No deviation

Deviation

V — Measure the voltage

Ω — Measure the resistance

Playback is good


Playback is not good

REC — Recording is good

Recording is not good

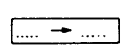
Echo is not good

Multiplay is not good

Sound

No Sound

Inject an LF signal


Check circuit between ... and ...

Indicator functions

Indicator does not function

# Service Information

18-9-1972

N4450 - N4418 - N4416 - N4414 - N4510

Bc 1301

PHILIPS

Due to a printing error the code number of a test tape as stated in some of the abovementioned service manuals is incorrect.
The correct code number of the test tape, 3150 Hz - 19 cm/sec is 8222 305 11550.

---

Par suite d'une faute d'imprimerie, le no. de code de la bande d'essai dans quelques documentations techniques est erroné.
Le no. de code correct de la bande d'essai 3150 Hz - 19 cm/sec est 8222 305 11550.

---

Debido a un error de imprenta en algunos de las documentaciones arriba mencionadas es dado un número de código erróneo para un cinta de prueba.
El número de código correcto debe ser:
Cinta de prueba 3150 Hz - 19 cm/seg., número de código 8222 305 11550.

---

Ten gevolge van een drukfout staat in een gedeelte van bovengenoemde dokumentaties het kodenummer van een testband verkeerd vermeld.
Het juiste kodenummer moet zijn:
Testband 3150 Hz - 19 cm/sek, kodenummer 8222 305 11550.

---

Infolge eines Druckfehlers ist die Code-Nummer für ein Testband in obengenannten Dokumentationen falsch angegeben.
Die richtige Code-Nummer ist:
Testband 3150 Hz - 19 cm/s, Code-Nummer 8222 305 11550.

---

SERVICE

CS34759

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Printed in the Netherlands

# Service Information

1974-01-02

RECORDERS N4450

AR 73-12

PHILIPS

A. Modifications in recorders

. Version WR09
In recorders, marked from WR09/243 the following resistors in the amplifier have been replaced:

| | Original value | New value |
|---|---|---|
| R3/R103 | 5.1 kΩ | 6.8 kΩ |
| R4/R104 | 75 kΩ | 100 kΩ |
| R7/R8/R107/R108 | 22 kΩ | 7.5 kΩ |
| R9/R109 | 820 kΩ | 270 kΩ |

(all resistors 1/8 W ± 5 %)
This modification has been made to improve the dynamics of the recording amplifier.

. In recorders, marked from WR09/303, the tape tension comparators 84 have been provided with dampers. These dampers consist of two plastic discs between which there is a silicon liquid. For the code numbers of the new parts and the sequence of mounting, see Fig. 1.
Note:
The two plastic discs (with silicon liquid) have been pressed together in a special manner. Therefore, the discs must on no account be separated when they are mounted.

. In recorders, marked from WR09/304, resistor R202 (2.2 kΩ - 1/8 W ± 5 %) has been added on p.c. board 2 (see Fig. 2). Furthermore, the diodes D10 and D11 (BZX88/C3V3) on the RESET/AUTOMATIC REVERSE UNIT P201 have been replaced by BZX79/C4V7. This modification has been introduced because the recorder sometimes stopped at any moment when the remote control unit N6719 was used.

. In recorders, marked from WR09/304, the coils L701, L702, L703 and L704 and the capacitors C703 and C704 have been left out. In recorders, marked from WR09/309, the capacitors have been reintroduced, to avoid motor sparks.

. In recorders, marked from WR09/309, resistor R39 has been replaced; the value was 560 Ω and is now 1.5 kΩ (safety resistor; code number 4822 110 63112), and capacitor C14 (220 μF - 25 V) has been replaced by a capacitor of 220 μF - 16 V (code number 4822 124 20473). As a consequence, C14 becomes smaller, and therefore the roll shutter 176 cannot push against the capacitor anymore.

. In recorders, marked from WR09/309, the following modifications on p.c. board 1 have been made (see Fig. 3):
- the connecting surfaces for soldering the socket contacts have been enlarged;
- the lampholders have been left out because the connecting wires of the lamps are soldered direct to the p.c. board.

. In recorders, marked from WR09/311, a screening plate has been fitted between switch SK5 and unit P10 (PRE-EMPHASIS/SPEED SELECTOR UNIT).
This modification has been introduced to prevent crosstalk between track 3 and track 1.

. In recorders, marked from WR09/323, the following modifications have been made on p.c. board 2 (see Fig. 2):
- the print tracks have been modified;
- the diodes D277, 278, 279, 280, 281, 282 and the resistors R232, 233, 234 are fitted to the component side.

. Version WR10
In recorders, marked from WR10/334, transistor TS201 (2SC931) has been replaced by BD437. The code number of this transistor is 4822 130 40982.
Note:
Under code number 4822 130 40899, transistor D330D8D will be supplied by Service for the time being. This transistor can also be used instead of 2SC931.

. In recorders, marked from WR10/334, the frequency range has been increased from 20,000 Hz to 25,000 Hz at 19 cm/s. Therefore, the PLAYBACK UNIT and the PRE-EMPHASIS/SPEED SELECTOR UNIT have been modified. The new units have the following code numbers:
- PLAYBACK UNIT 4822 218 30152
- PRE-EMPHASIS/SPEED SELECTOR UNIT 4822 218 30153

. Version WR11
In recorders, marked from WR11/335, the reel discs, have been provided with a conducting rubber ring and an earthing spring to eliminate the static charge.
The new reel discs can be used instead of the old ones. The code number is 4822 528 10293.

B. Addenda to the Service Manual

. Modified adjusting method for RECORDING UNIT P4/P104

Recorder in position : Recording - "TAPE" - "B" - "ST" - "NOR" - "9.5" potentiometer "REC" at maximum; other controls at minimum

| | | |
|---|---|---|
| Input: | BU2 TAPE IN/OUT 3/2 | 333 Hz - 0.1 V |
| Output: | BU5 MONITOR 3/2 | to be adjusted to 1 V with R4 on P5 |
| Input: | BU2 TAPE IN/OUT 5/2 | 333 Hz - 0.1 V |
| Output: | BU5 MONITOR 5/2 | to be adjusted to 1 V with R4 on P105 |
| Input: | BU2 TAPE IN/OUT 5/2 | 333 Hz - 1 V |
| Output: | BU5 MONITOR 5/2 | to be adjusted to 1 V with recording control "REC" |
| Input: | BU2 TAPE IN/OUT 3/2 | 333 Hz - 1 V |
| Output: | BU5 MONITOR 3/2 | value to be measured 1 V ± x V (x = max. 0.8 V). The difference with respect to 1 V to be halved with R4 on P5. |
| Output: | BU4 PHONO 6/2 (MP1) | to be adjusted to 1.5 mV with R9 on P4 |
| Input: | BU2 TAPE IN/OUT 5/2 | 333 Hz - 1 V |
| Output: | BU5 MONITOR 5/2 | value to be measured 1 V ± y V (y = max. 0.8 V). The difference with respect to 1 V to be halved with R4 on P105. If then $\frac{x}{2} \neq \frac{y}{2}$, the difference voltage with respect to 1 V is to be halved again. |
| Output: | BU4 PHONO 7/2 (MP101) | to be adjusted to 1.5 mV with R9 on P104 |

Note:
To avoid that the bias current is also measured, the oscillator unit P9 must be taken out of the recorder.

. Correction of the adjustment of the bias current.
With this adjustment, switch SK3 "B-A" must be in position "A".

. In some cases it may occur that the magnetic field of the ring on the pulley of capstan motor M3, decreases. This may be ascertained if the output voltage of pulse head K4 is measured.
The table below states these voltages for various tape speeds.

| Tape speed | Output voltage K4 |
|---|---|
| 4.75 cm/s | 54 mV |
| 9.5 cm/s | 110 mV |
| 19 cm/s | 175 mV |

. In part I of the Service Manual, the impression is created that this circuit is protected from short-circuit of the output. However, the output stage is protected only from failing owing to too strong input signals.

SERVICE

CS39085

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A. Änderungen im Gerät

. Ausführung WR09
Bei Geräten ab Stempelung WR09/243 wurden folgende Widerstände im Verstärker geändert:

| | |
|---|---|
| R3/R103 | war 5,1 kΩ wird 6,8 kΩ |
| R4/R104 | war 75 kΩ wird 100 kΩ |
| R7/R8/R107/R108 | war 22 kΩ wird 7,5 kΩ |
| R9/R109 | war 820 kΩ wird 270 kΩ |

(alle Widerstände 1/8 W ± 5 %)
Durch diese Änderung wird die Dynamik des Aufnahmeverstärkers verbessert.

. Bei Geräten ab Stempelung WR09/303 haben die Bandspannungskomparatoren 84 Dämpfer erhalten. Diese Dämpfer bestehen aus zwei Kunststoffscheiben mit einer Zwischenlage aus Silikonöl. Für die Kodenummern der neuen Einzelteile und die Montage siehe Abb. 1.
Achtung:
Die beiden Kunststoffscheiben werden in der Fabrik mit Silikonöl bestrichen und nach einem bestimmten Verfahren zusammengepresst. Die Scheiben dürfen deshalb bei der Montage auf keinen Fall getrennt werden.

. Bei Geräten ab Stempelung WR09/304 ist auf Leiterplatte 2 der Widerstand R202 (2,2 kΩ - 1/8 W ± 5 %) hinzugefügt (siehe Abb. 2). Gleichzeitig mit dieser Änderung wurden auf der RESET/AUTOMATIC REVERSE UNIT P201 die Dioden D10 und D11 von BZX88/C3V3 in BZX79/C4V7 geändert. Diese Änderung wurde eingeführt, weil das Gerät bei Verwendung der Fernbedienungseinheit N6719 manchmal ohne Grund stoppte.

. Bei Geräten ab Stempelung WR09/304 sind die Spulen L701, L702, L703 und L704 sowie die Kondensatoren C703 und C704 entfallen. Ab Stempelung WR09/309 wurden diese Kondensatoren wieder eingeführt, um Störungen durch den Motor zu unterdrücken.

. Bei Geräten ab Stempelung WR09/309 ist Widerstand R39 von 560 Ω in 1,5 kΩ (Sicherheitswiderstand; Kodenummer 4822 110 63112) und Kondensator C14 von 220 µF - 25 V in 220 µF - 16 V (Kodenummer 4822 124 20473) geändert. Weil der neue Kondensator C14 kleiner ist, kann die Jalousie 176 nicht mehr an den Kondensator stossen.

. Bei Geräten ab Stempelung WR09/309 wurden auf Leiterplatte 1 u.a. folgende Änderungen vorgenommen (siehe Abb. 3):
- die Anschlussflächen für das Löten der Buchsenkontakte wurden vergrössert;
- die Lampenfassungen sind entfallen, weil die Anschlussdrähte der Lampen jetzt direkt auf die Leiterplatte gelötet werden.

. Bei Geräten ab Stempelung WR09/311 wird zwischen Schalter SK5 und Einheit P10 (PRE-EMPHASIS/SPEED SELECTOR UNIT) eine Abschirmplatte montiert. Durch diese Änderung soll Übersprechen zwischen Spur 3 und Spur 1 vermieden werden.

. Bei Geräten ab Stempelung WR09/323 wurden auf Leiterplatte 2 u.a. folgende Änderungen vorgenommen (siehe Abb. 2):
- Leiterbahnen geändert
- die Dioden D277, 278, 279, 280, 281 und 282 und die Widerstände R232, 233, 234 werden auf der Bauelementeseite der Leiterplatte montiert.

. Ausführung WR10
Bei Geräten ab Stempelung WR10/334 ist Transistor TS201 von 2SC931 in BD437 geändert. Kodenummer dieses Transistors: 4822 130 40982.
Anmerkung:
Unter der Kodenummer 4822 130 40899 liefert der Service vorläufig den Transistor D330D8D, der ebenfalls an Stelle des 2SC931 verwendet werden kann.

. Bei Geräten ab Stempelung WR10/334 ist der Frequenzbereich bei 19 cm/s von 20.000 Hz auf 25.000 Hz erhöht. Hierzu wurden die PLAY-BACK UNIT und die PRE-EMPHASIS/SPEED SELECTOR UNIT geändert. Die neuen Einheiten sind unter folgenden Kodenummern lieferbar:
- PLAYBACK UNIT 4822 218 30152
- PRE-EMPHASIS/SPEED SELECTOR UNIT 4822 218 30153

. Ausführung WR11
Bei Geräten ab Stempelung WR11/335 erhalten die Spulenteller einen Ring aus leitendem Gummi und eine Erdungsfeder, um statische Ladung abzuleiten. Diese neuen Spulenteller können an Stelle der alten montiert werden. Kodenummer: 4822 528 10293.

B. Ergänzungen der Dokumentation

. Geänderte Einstellmethode RECORDING UNIT P4/P104

Tonbandgerät
in Stellung : Aufnahme - "TAPE" - "B" - "ST" - "NOR" - "9,5"
Aufnahmeregler "REC" auf Maximum; andere Regler auf Minimum

| | | |
|---|---|---|
| Eingang: | BU2 TAPE IN/OUT 3/2 | 333 Hz - 0,1 V |
| Ausgang: | BU5 MONITOR 3/2 | mit R4 auf P5 einstellen auf 1 V |
| Eingang: | BU2 TAPE IN/OUT 5/2 | 333 Hz - 0,1 V |
| Ausgang: | BU5 MONITOR 5/2 | mit R4 auf P105 einstellen auf 1 V |
| Eingang: | BU2 TAPE IN/OUT 5/2 | 333 Hz - 1 V |
| Ausgang: | BU5 MONITOR 5/2 | mit Aufnahmeregler "REC" einstellen auf 1 V |
| Eingang: | BU2 TAPE IN/OUT 3/2 | 333 Hz - 1 V |
| Ausgang: | BU5 MONITOR 3/2 | zu messender Wert 1 V ± x V (x = max. 0,8 V). Die Differenz gegenüber 1 V mit R4 auf P5 halbieren. |
| Ausgang: | BU4 PHONO 6/2 (MP1) | mit R9 auf P4 einstellen auf 1,5 mV |
| Eingang: | BU2 TAPE IN/OUT 5/2 | 333 Hz - 1 V |
| Ausgang: | BU5 MONITOR 5/2 | zu messender Wert 1 V ± y V (y = max. 0,8 V). Die Differenz gegenüber 1 V mit R4 auf P105 halbieren. Wenn danach $\frac{x}{2} \neq \frac{y}{2}$ erneut die Differenzspannung gegenüber 1 V halbieren. |
| Ausgang: | BU4 PHONO 7/2 (MP101) | mit R9 auf P104 auf 1,5 mV einstellen. |

Achtung:
Um zu verhindern, dass auch die Vormagnetisierungsspannung gemessen wird, die Oszillatoreinheit P9 aus dem Gerät nehmen.

. Korrektur der Einstellung des Vormagnetisierungsstromes
Bei dieser Einstellung muss Schalter SK3 "B-A" in Stellung "A" stehen.

. In Einzelfällen kann es vorkommen, dass das Feld des magnetisierten Ringes auf der Stufenscheibe des Bandantriebsmotors M3 abnimmt. Dies kann man durch Messen der Ausgangsspannung des Impulskopfes K4 feststellen.
In untenstehender Tabelle sind diese Spannungen für die einzelnen Bandgeschwindigkeiten angegeben:

| Bandgeschwindigkeit | Ausgangsspannung K4 |
|---|---|
| 4,75 cm/s | 54 mV |
| 9,5 cm/s | 110 mV |
| 19 cm/s | 175 mV |

. Bei der Beschreibung der Endstufe in Teil I der Dokumentation wird der Eindruck erweckt, dass der Ausgang der Schaltung kurzschlussfest ist. Das ist nicht der Fall. Die Endstufe ist nur vor Beschädigungen durch zu hohe Eingangsspannungen geschützt.

A. Modificaciones en el aparato

. Versión WR09
En los aparatos a partir del estampillado WR09/243 han sido modificados las siguientes resistencias:

| | |
|---|---|
| R3/R103 | era 5,1 kΩ y es ahora 6,8 kΩ |
| R4/R104 | era 75 kΩ y es ahora 100 kΩ |
| R7/R8/R107/R108 | era 22 kΩ y es ahora 7,5 kΩ |
| R9/R109 | era 820 kΩ y es ahora 270 kΩ |

(todas las resistencias 1/8 W ± 5 %)
Esta modificación es introducida a fin de mejorar la dinámica del amplificador de registro.

. En los aparatos a partir del estampillado WR09/303 los "tape tension comparators" 84 son provistos de amortiguadores. Estos amortiguadores son compuestos de dos discos de material sintético entre los cuales hay un liquido de silicon. Para los números de código de estos nuevos componentes y el orden de montaje véase a la figura 1.
Atención:
Los dos discos de material sintético son provistos por la fábrica de liquido silicona y comprimidos de una manera especial. Por ello estos discos no deben ser separados jamás durante el montaje.

. En aparatos a partir del estampillado WR09/304 es anadido la resistencia R202 (2,2 kΩ - 1/8 W ± 5 %) sobre la placa impresa 2 (véase la fig. 2). Al mismo tiempo son modificados los diodos D10 y D11 sobre la unidad RESET/AUTOMATIC REVERSE P201 de BZX88/C3V3 en BZX79/C4V7. Esta modificación es introducida debido a que el aparato se paraba a veces sin razón alguna al ser usado la unidad de mando a distancia N6719.

. En aparatos a partir del estampillado WR09/304 han sido suprimidos las bobinas L701, L702, L703 y L704 y los condensadores C703 y C704. A partir del estampillado WR09/309 los condensadores son nuevamente introducidos a fin de evitar chasquidos de motor.

. En aparatos a partir del estampillado WR09/309 es modificado la resistencia de 560 Ω en 1,5 kΩ (resistencia de seguridad; número de código 4822 110 63112) y el condensador C14 de 220 μF - 25 V en 220 μF - 16 V (número de código 4822 124 20473). Como que por ello C14 es más pequeno, la tapa corrediza no chocará más contra este.

. En aparatos a partir del estampillado WR09/309 son introducidos los siguientes modificaciones sobre la placa impresa 1 (véase la fig. 3)
- las superficies de conexión para soldar a los contactos del enchufe son agrandadas
- los portalamparillas han quedado suprimidos ya que las lamparillas son soldados directamente sobre la placa impresa.

. En aparatos a partir del estampillado WR09/311 es montado una plaquecilla de blindaje entre el conmutador SK5 y la unidad P10 (PRE-EMPHASIS/SPEED SELECTOR UNIT). Esta modificación es introducida a fin de evitar la influencia mutua entre los pistas impresas 3 y 1.

. En aparatos a partir del estampillado WR09/323 son introducidos las siguientes modificaciones sobre la placa impresa 2 (véase la fig. 2):
- trazado impreso modificado
- los diodos D277, 278, 279, 280, 281, 282 y las resistencias R232, 233, 234 son montados sobre el lado de componentes de la placa impresa.

. Versión WR10
En aparatos a partir de WR10/334 es modificado el transistor TS201 de 2SC931 en BD437. El número de código de este transistor es 4822 130 40982.
Nota:
El Servicio suministra temporaneamente al transistor D330D8D bajo el número de código 4822 130 40899, cual puede ser aplicado también en lugar del 2SC931.

. En aparatos a partir del estampillado WR10/334 es aumentado el margen de frecuencia de 20 000 Hz hasta 25 000 Hz para 19 cm/seg.
Para esto son modificados la unidad de PLAYBACK y la unidad de PRE-EMPHASIS/SPEED SELECTOR. Las nuevas unidades son suministrados bajo los siguientes números de código:

| | |
|---|---|
| - PLAYBACK UNIT | 4822 218 30152 |
| - PRE-EMPHASIS/SPEED SELECTOR UNIT | 4822 218 30153 |

. Versión WR11
En aparatos a partir del estampillado WR11/335 los platos de bobina son provistos de un aro de caucho conductor y un resorte lámina de masa a fin de hacer afluir la carga electrostática.
Los platos de bobina no modificados pueden ser sustituidos sin más por estos nuevas.
El número de código es 4822 528 10293.

B. Suplemento a la documentación

. Método de ajuste modificado para RECORDING UNIT P4/P104.

Magnétofono
en posición : Resistro - "TAPE" - "B" - "ST" - "NOR" - "9,5"
Control de registro "REC" al máximo; todos los demás controles al mínimo.

| | | |
|---|---|---|
| Entrada: | BU2 TAPE IN/OUT 3/2 | 333 Hz - 0,1 V |
| Salida: | BU5 MONITOR 3/2 | ajústese con R4 sobre P5 a 1 V |
| Entrada: | BU2 TAPE IN/OUT 5/2 | 333 Hz - 0,1 V |
| Salida: | BU5 MONITOR 5/2 | ajústese con R4 sobre P105 a 1 V |
| Entrada: | BU2 TAPE IN/OUT 5/2 | 333 Hz - 1 V |
| Salida: | BU5 MONITOR 5/2 | ajústese con el control de registro "REC" a 1 V |
| Entrada: | BU2 TAPE IN/OUT 3/2 | 333 Hz - 1 V |
| Salida: | BU5 MONITOR 3/2 | valor a medirse 1 V ± x V (x = 0,5 V max). Mediar la diferencia con respecto a 1 V mediante R4 sobre P5. |
| Salida: | BU4 PHONO 6/2 (MP1) | ajústese mediante R9 sobre P4 a 1,5 mV |
| Entrada: | BU2 TAPE IN/OUT 5/2 | 333 Hz - 1 V |
| Salida: | BU5 MONITOR 5/2 | valor a medirse 1 V ± y V (y = 0,5 V max). Mediar la diferencia con respecto a 1 V mediante R4 sobre P105. Si luego $\frac{x}{2} \neq \frac{y}{2}$ entonces mediar nuevamente la diferencia con respecto a 1 V. |
| Salida: | BU4 PHONO 7/2 (MP101) | ajústese mediante R9 sobre P104 a 1,5 mV |

Atención:
Afin de evitar de que se nude a la vez a la tensión de premagnetización hay que quitar del aparato a la unidad osciladora P9.

. Rectificación del ajuste de la corriente de prémagnetización
Para este ajuste el conmutador SK3 "B-A" debe hallarse en la posición "A".

. En algunos casos puede suceder que el campo magnético del aro magnetizado, cual se encuentra sobre la polea del motor de cabrestante M3, disminuye. Esto puede ser constatado nudiéndose a la tensión de salida de la cabeza de impulsos K4.
En la tabla a continuación son dados estas tensiones para los diversos velocidades de cinta.

| Velocidad de cinta | Tension de salida K4 |
|---|---|
| 4,75 cm/seg. | 54 mV |
| 9,5 cm/seg. | 110 mV |
| 19 cm/seg. | 175 mV |

. En la parte I de la documentación es dado la impresión en la descripción de la etapa final de que este circuito es segurado contra el cortocircuitado de la salida. Esto no es así.
La etapa final es solamente segurado contra el defectuarse debido a senales de entrada demasiados grandes.

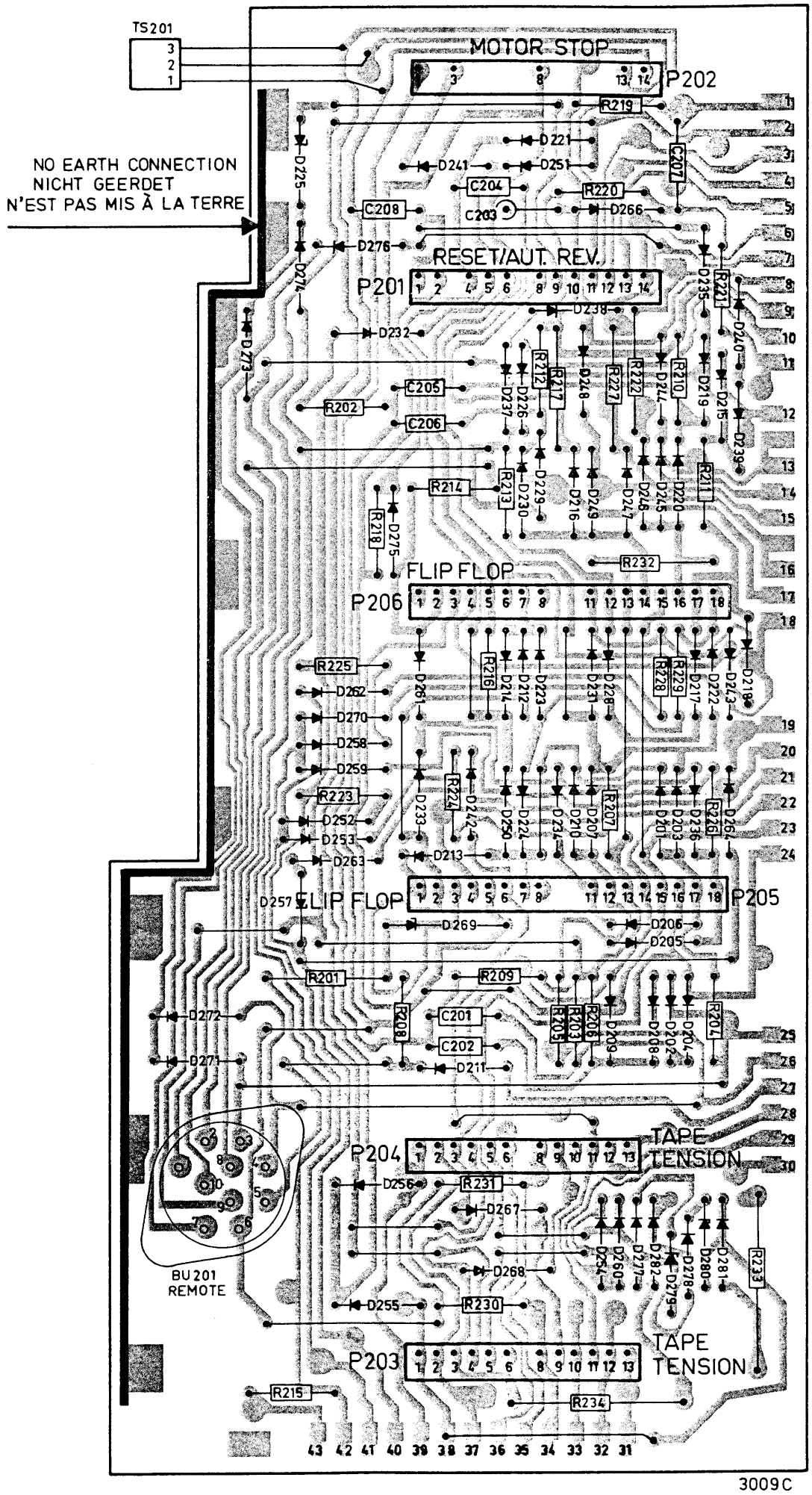

TS201
3
2
1
NO EARTH CONNECTION
NICHT GEERDET
N'EST PAS MIS À LA TERRE
MOTOR STOP
P202
RESET/AUT. REV.
P201
FLIP FLOP
P206
FLIP FLOP
P205
TAPE TENSION
P204
TAPE TENSION
P203
BU 201
REMOTE
3009C

Fig. 2

# Service Information

1973-09-28

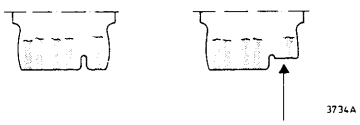
FUNCTIONAL UNITS
N4414, N4416, N4418, N4450, N4510

AR 73-24

PHILIPS

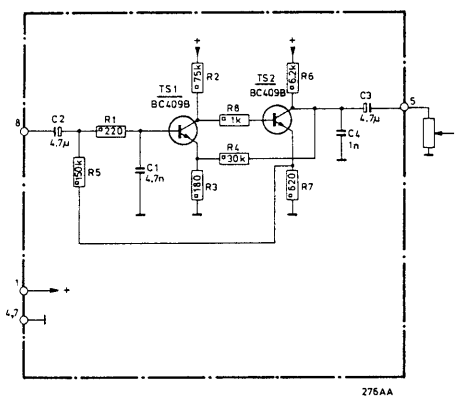
This information summarises the modifications to all Functional Units of the above-mentioned recorders.

General remark



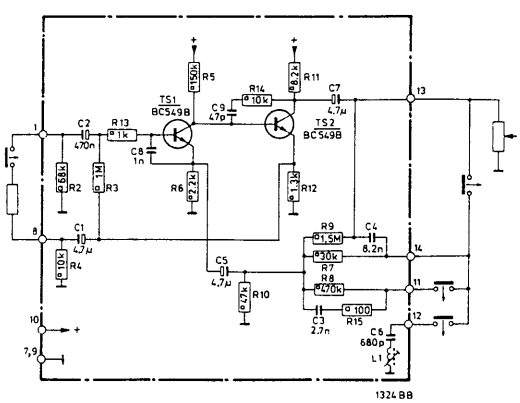

- The form of the unit has been modified. Thus, it will not occur that, when a unit is drawn out of the recorder, one of its corners breaks off.

## MICRO INPUT UNIT — N4450




- TS1,2 - BC149B have been replaced with BC409B. Thus, the roller shutters in front of the input sockets will not slide against the transistors.

## UNIVERSAL INPUT UNIT — N4418, N4450, N4510




- R9 - 620 kΩ has been replaced with a resistor of 1.5 MΩ. Thus, the frequency range for "Phono" has been improved. This modification has been made in recorders N4450 marked from WR07/150.
  Note: The N4418 and the N4510 have been featuring this modification from the start of production.
- TS1,2 - BC149B have been replaced with BC549B. Thus, fitting the transistors has been facilitated.

SERVICE

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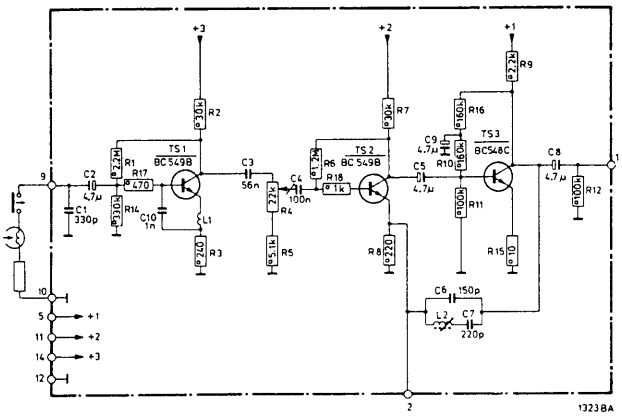
## PLAYBACK UNIT

N4418, N4450, N4510




- C1 - 680 pF has been replaced with a capacitor of 330 pF. Thus, the frequency characteristic has been improved up to 25 kHz at v = 19 cm/s.
  This modification has been made in recorders marked from WR07/327 (N4418), WR10/334 (N4450) or WR02/327 (N4510).
- Three transistors have been replaced.

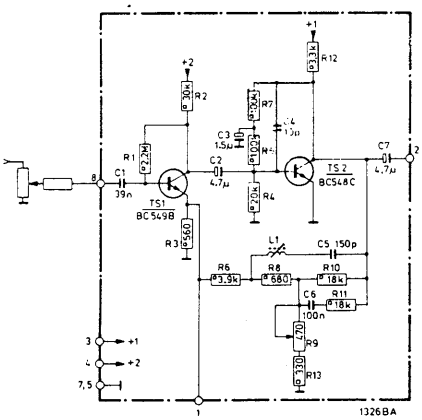
| Original types | Replacement types |
|---|---|
| TS1,2 - BC149B | BC549B |
| TS3 - BC148C | BC548C |

Thus, fitting the transistor has been facilitated.

Note: The units containing the modifications to obtain an improved frequency characteristic are supplied under code number 4822 218 30152.

## RECORDING UNIT

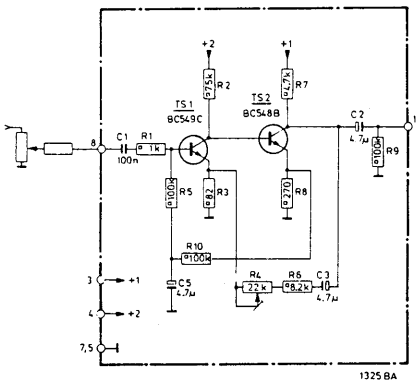
N4418, N4450, N4510




- The correct value of R13 is 330 Ω.
- TS1 - BC149C has been replaced with BC549C, and TS2 - BC148B with BC548B. Thus, fitting these transistors has been facilitated.

## BEFORE TAPE UNIT

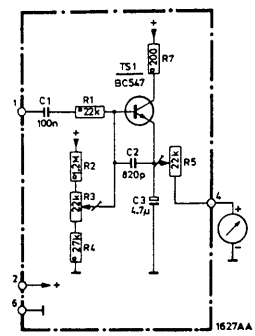
N4418, N4450, N4510




- TS1 - BC149C has been replaced with BC549C, and TS2 - BC148B with BC548B. Thus, fitting these transistors has been facilitated.

## INDICATOR UNIT

N4416, N4418, N4450, N4510

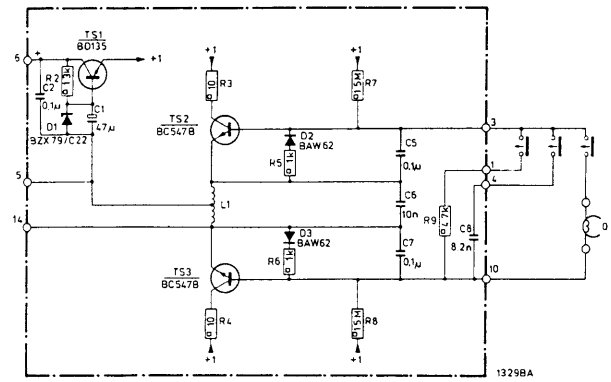



- Two resistors have replaced:

| Original type | Value of replacement type |
|---|---|
| R2 - 1.5 MΩ | 1.2 MΩ |
| R4 - 12 kΩ | 27 kΩ |

Thus, the quiescent current can be better adjusted.
The recorders have been featuring this modification from the start of production.
- TS2 - BC147 has been replaced with BC547. Thus, fitting this transistor has been facilitated.

## OSCILLATOR UNIT — N4418, N4450, N4510

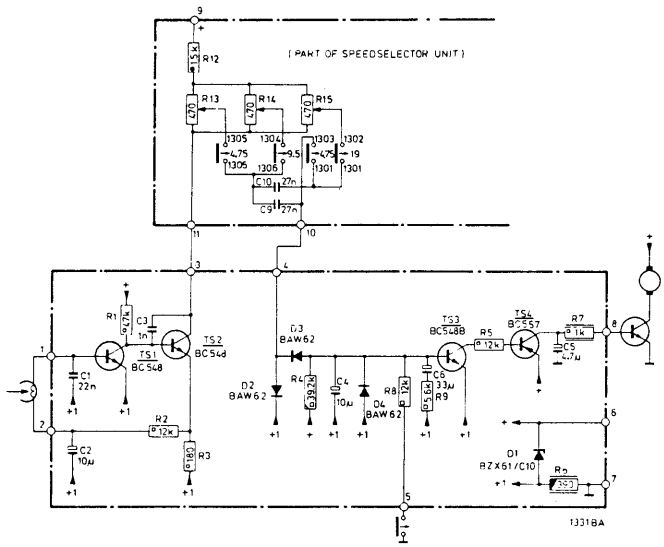



- The erase frequency has been reduced from 114 kHz to 100 kHz. Thus, MW reception has been improved.
  Owing to this modification, C3, C4, C9 and C10 are no longer used. Besides, some capacitors have been replaced.

| Replaced capacitors | Value of replacement type |
|---|---|
| C5 and C7 - 56 pF | 0.1 µF |
| C6 - 8.2 nF | 10 nF |
| C8 - 6.2 nF | 8.2 nF |

  D1 - BZX79/C20 has been replaced with BZX79/C22; besides, R5 and R6 (10 kΩ each) have been replaced with resistors of 1 kΩ; they are now is series with D2 and D3 respectively. Thus, the erasing capacity has been improved.
  These modifications have been made in recorders marked from WR06/148 (N4450).
  The N4418 and N4510 have been featuring these modifications from the start of production.
- D2,3 - BA216 have been replaced with BAW62. Thus, the reliability has been improved.
  This modification has been made in: N4418 marked from WR07/322, N4450 marked from WR09/322, N4510 marked WR02/322.
- TS2,3 - BC147B have been replaced with BC547B. Thus, fitting the transistors has been facilitated.

## SPEED CONTROL UNIT — N4418, N4450, N4510

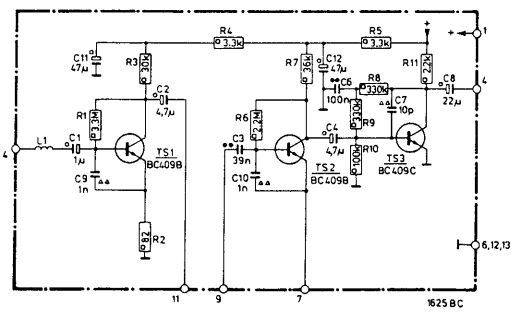



- D1 - BZX79/C10 has been replaced with BZX61/C10. Thus, the reliability has been improved.
  This modification has been made in recorders marked from WR07/317 (N4418), from WR09/316 (N4450), or from WR02/317 (N4510).
- D2,3 - BA217 have been replaced with BAW62; D4 - BA216 has been replaced with BAW62. Thus, the reliability has been improved. These modifications have been made in recorders marked from: WR07/304 (N4418), WR09/304 (N4450), WR02/304 (N4510)
- Some transistors have been replaced.

| Original type | Replacement type |
|---|---|
| TS1,2 - BC148 | BC548 |
| TS3 - BC148 | BC548B |
| TS4 - BC157 | BC557 |

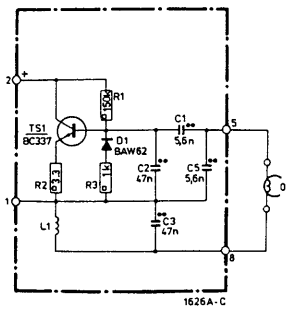
  Thus, fitting these transistors has been facilitated.

## REC/PLAYBACK UNIT — N4414, N4416



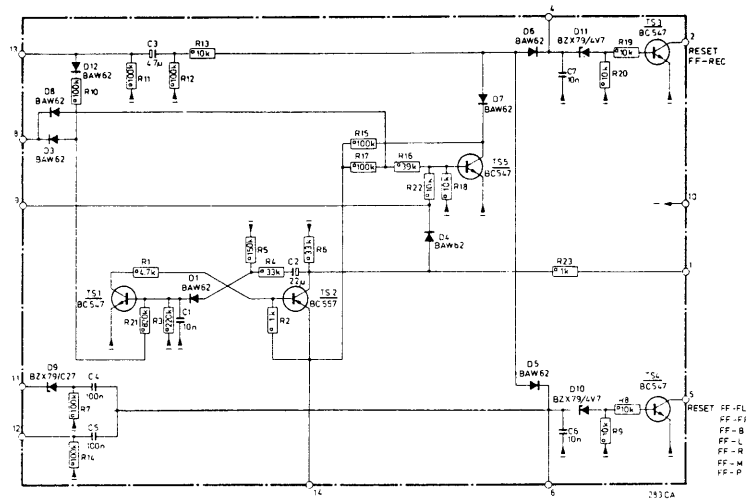

- The circuit has been modified as a consequence of standardisation. The unit can now also be used in the N2407, N2408 and N2509.
  The modified unit can also be used in recorders of an earlier production.
  In recorders produced after this modification was made, the new unit (marked 11.2 on the track side) must be used.
  This modification has been made in recorders marked from WR02/304 (N4414) or WR04/302 (N4416).

## OSCILLATOR UNIT — N4414, N4416



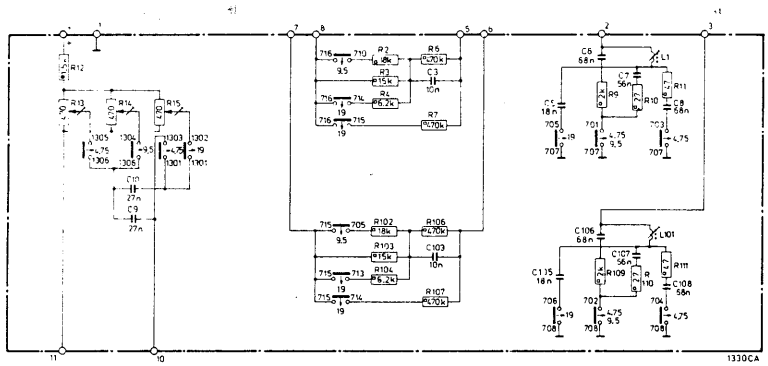

- D1 - BA217 has been replaced with BAW62. Thus, the reliability has been increased.
  This modification has been made in recorders marked from WR02/304 (N4414) or WR04/304 (N4416).

## RESET-AUTOMATIC REVERSE UNIT — N4450



- D10, 11 - BZX88/C3V3 have been replaced with BZX79/C4V7. Thus, it has been avoided that the recorder suddenly stops when remote control N6719 is being used.
  This modification has been made in a limited number of recorders marked from WR09/240 and in all recorders marked from WR09/304.
- D9 - BZX79/C30 has been replaced with BZX79/C27. Thus, the switch clock will again function properly at too low a mains voltage.
  This modification has been made in recorders marked from WR09/333.
- D1,3,4,5,6,7,8,12 - BA217 have been replaced with BAW62. Thus, the reliability has been increased.
  This modification has been made in WR09/304.
- TS1,3,4 and 5 - BC147 have been replaced with BC547; TS2 - BC157 has been replaced with BC557.

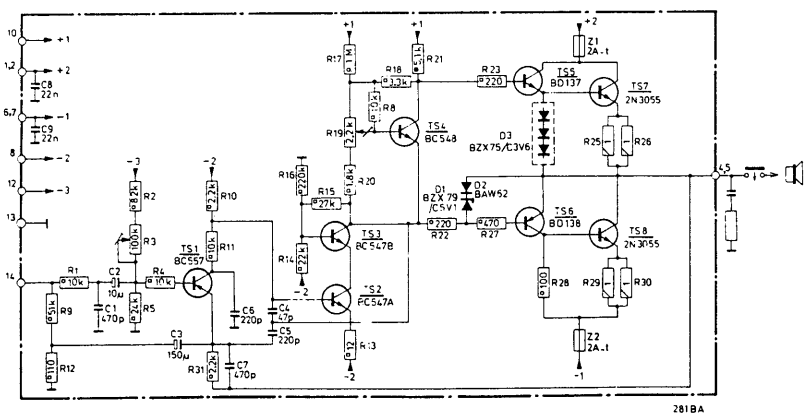
## PRE-EMPHASIS/SPEED SELECTOR UNIT — N4418, N4450, N4510



- R8, 108 are no longer used and C5, 105 - 27 nF have been replaced with capacitors of 8 nF. Thus, the frequency characteristic has been improved up to 25 kHz at v = 19 cm/s.
  This modification has been made in recorders marked from:
  WR07/327 (N4418)
  WR10/334 (N4450)
  WR02/327 (N4510)

Note: The units containing the modifications to obtain an improved frequency characteristic are supplied under code number 4822 218 30153.

## POWER OUTPUT UNIT — N4450

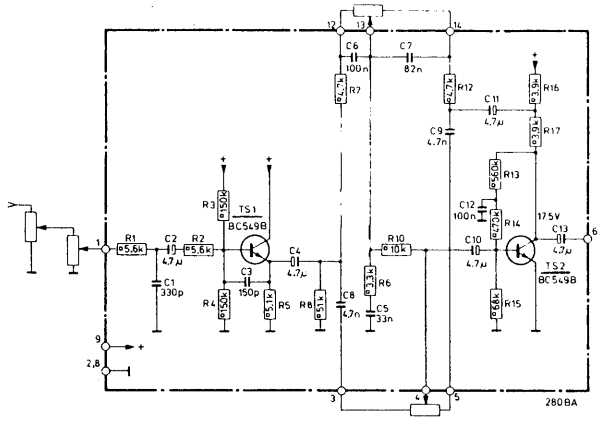


TS5,6 - 2N2219A, 2N2905A have been replaced with transistor pair BD137/138. This modification has been made in recorders marked from WR09/306.
R24 has been replaced with stabistor D3 - BZX75/C3V6. Thus, the fuses cannot fail.
This modification has been made in recorders marked from WR09/329.
D2 - BAX13 has been replaced with BAW62 because of a new supply programme.
The following transistors have been replaced.

| Original type | Replacement type |
|---|---|
| TS1 - BC157 | BC557 |
| TS2 - BC147A | BC547A |
| TS3 - BC147B | BC547B |
| TS4 - BC148 | BC548 |

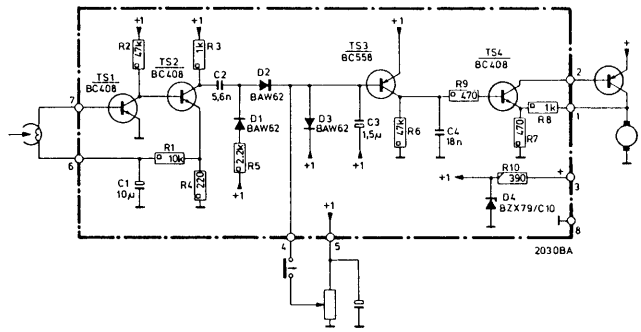
Thus, fitting these transistors has been facilitated.

## TONE CONTROL UNIT — N4450



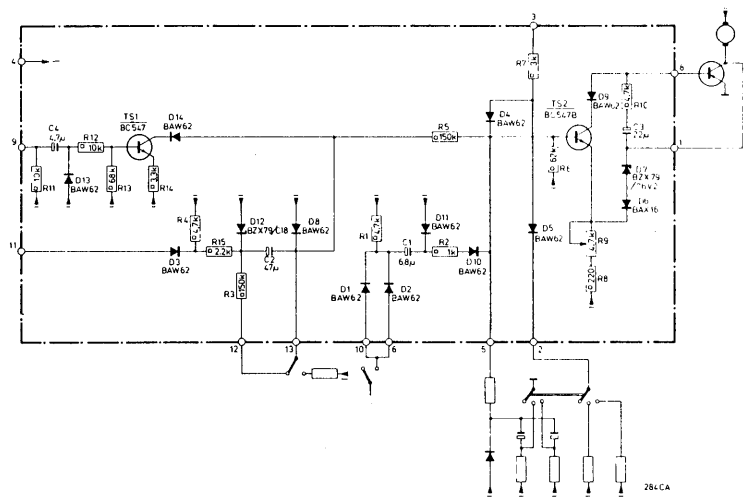

- TS1,2 - BC149B have been replaced with BC549B. Thus, fitting these transistors has been facilitated.

## SPEED CONTROL UNIT — N4414, N4416



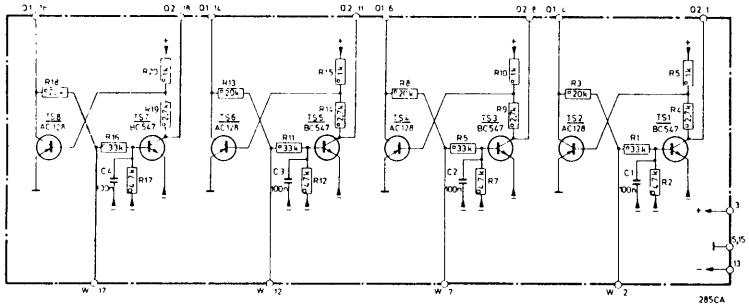

- D4 - BZX79/C10 has been replaced with BZX61/C10. Thus, the reliability has been improved. This modification has been made in recorders marked from WR02/317 (N4414) or from WR04/317 (N4416).
- D1,2,3 - BA217 have been replaced with BAW62 because the range of diodes has been changed.
- TS3 - BC158 has been replaced with BC558. Thus, fitting this transistor has been facilitated.

## TAPE TENSION UNIT — N4450



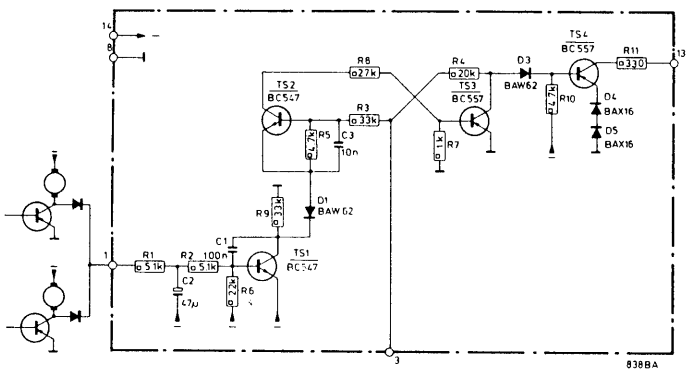

- D1,2,3,4,5,9,10,11,13,14 - BA217 have been replaced with BAW62 because of the changed range of diodes.
- TS1 - BC147 and TS2 - BC147B have been replaced with BC547 and BC547B respectively. Thus, fitting these transistors has been facilitated.

## FLIP FLOP UNIT — N4450



- TS1,3,5,7 - BC147 have been replaced with BC147. Thus, fitting these transistors has been facilitated.

## MOTOR STOP UNIT — N4450

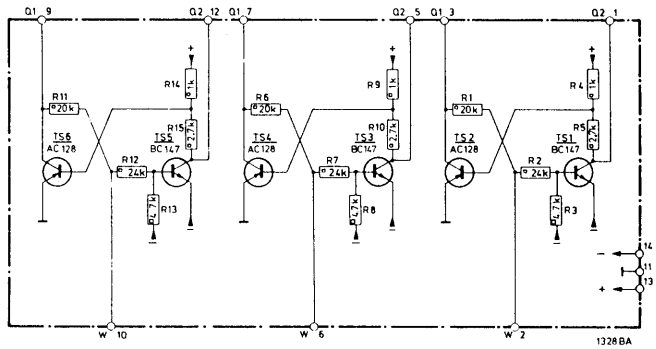


- D1,3 - BA217 have been replaced with BAW62 because of the new range of diodes.
- Replaced transistors

| Original type | Replacement type |
|---|---|
| TS1,2 - BC147 | BC547 |
| TS3,4 - BC157 | BC557 |

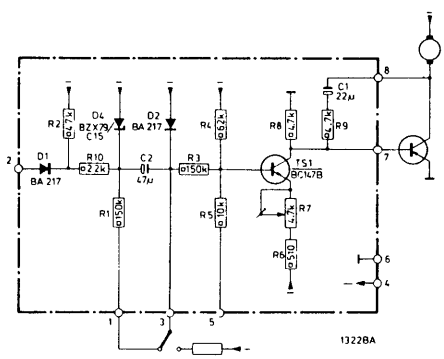
Thus, fitting these transistors has been facilitated.

## FLIP FLOP UNIT — N4418, N4510



- R2,7,12 - 33 kΩ have been replaced with resistors of 24 kΩ. Thus, the brake and coil magnets are prevented from not being actuated at lower mains voltages.
  This modification has been made in recorders marked from WR06/244 (N4418) or from WR01/244 (N4510).

## TAPE TENSION UNIT — N4418, N4510



- R7 - 2.2 kΩ has been replaced with a resistor of 4.7 kΩ. Thus, the adjustment of the quiescent current has been facilitated.
  This modification has been made in recorders marked from WR04/202 (N4418) and in recorders N4510 from the start of production.
- R5 - 27 kΩ has been replaced with a resistor of 10 kΩ. Thus, the winding torque during forward winding has been increased.
  This modification has been made in recorders marked from WR06/236 (N4418) or WR01/236 (N4510).

# Service Information

1974-08-19

RECORDERS N4414-N4416-N4418-N4510-N4450

AR74-6

PHILIPS

To obtain an optimal sound reproduction and minimal head wear, the record and playback heads must be adjusted correctly. The tape transport can vary for each recorder; the heads are also made with certain tolerances. Therefore replaced heads must be re adjusted.
The height of the head and the azimuth can be adjusted with one single test tape. On this test tape a 10-kHz signal has been recorded over the full width. About 1.2 mm from the upperside of the tape there is a 1-mm wide track on which a signal of 1-kHz has been recorded.
When the height of the head has been adjusted correctly, the 1-kHz track is just under the uppermost core. The 1-kHz signal should then be just audible above the noise. When the azimuth alignment is correct, the core gaps are perpendicular to the running direction of the tape. Then there is a maximum reproduction of the 10-kHz signal.

**N4414-N4416**

Required tools and measuring instruments:

| | |
|---|---|
| - Head adjusting jig | 4822 403 50718 |
| - Test tape 1 kHz-10 kHz | 4822 397 30014 |
| - Spring pressure gauge 3-55 g | 4822 395 80029 |
| - mV-meter | GM6012 or PM2454B |
| - Dual-beam oscilloscope | PM3230 or PM3130 |

**Adjusting the head inclination (Fig. 1)**

Carefully check whether the front of the head is perpendicular to the mounting plate. Adjust with nut C.

**Adjusting the height of the head**

- With the adjusting jig
  . Place the jig in the recorder (Fig. 2)
  . The upperside of the uppermost core must be situated just below the upperside of the adjusting jig. Adjust with nuts B and C and screw A.
- With test tape
  . Insert the test tape into the recorder
  . Recorder in position "1-4" - "9.5" - "PLAY"
  . Adjust, with nuts B and C and screw A, the height of the head so that the 1 kHz signal is still just audible above the noise.

Attention:
The nuts B and C and screw A must be equally turned when the height of the head is being adjusted. Otherwise the adjustment of the head inclination would be changed.

**Adjusting the azimuth**

- Insert the test tape into the recorder
- Recorder in position "1-4" - "9.5" - "PLAY"
- Adjust with screw A the azimuth of the head so that the reproduction of the 10-kHz signal is maximal. Consequently, the reproduction of the 1-kHz signal may become stronger. Then the height of the head must be readjusted.

**Adjusting the head mirror**

- Connect a mV-meter so socket TAPE IN/OUT (point 5)
- Insert the test tape into the recorder
- Recorder in position "1-4" - "9.5" - "PLAY"
- Pull off the pressure felt pad in front of the head. The meter reading may decrease by 1 dB at most. If the deviation should be larger, loosen screw E and turn the head so that the deviation is $\leq 1$ dB.
- Check the azimuth adjustment of the head

Attention:
When fitting a new head, push it forwards as much as possible.

**Erase head**

Check whether the surface of the core next to the core gap is smooth. If this surface should be rough, the erase head must be replaced; otherwise the tape might be damaged.
A new erase head need not be readjusted. The tape guides of the erase head are a fixed point for the tape transport.
It is therefore suggested to check the tape transport after the erase head has been replaced. If necessary, correct the adjustment of the other tape guides as well. Use an adjusting jig for checking and adjusting.

**Pressure felt pads**

Check the condition of the pressure felt pads. If they should have become hard, they must be replaced.
Check the pressure force. The force of the felt pad in front of the erase head must be 5...10 g, and is measured at the upperside of bracket 72. To adjust the force, shorten or stretch spring 92. The force of the felt pad in front of the record/playback head must be 20...40 g, and is measured at the upperside of bracket 106. When rings (dia 2.2 mm) are added under spring 109, the force can be increased; by shortening the spring, the force is reduced. The clearance between the pressure roller bearing bracket and the nuts on pull rod 108 must be about 1.5 mm (pressure roller magnet attracted). Be sure that the pull rod can move freely !

**Capstan**

Check the adjustment of the capstan (see Service Manual). A slanting capstan causes a heavy wear of the tape. A slanting position of the capstan can recognised by the stepwise wear of the pressure roller.

**Cleaning**

After the heads have been adjusted or replaced, all tape guides, tape tension comparators, the capstan, the pressure roller etc. must be carefully cleaned with alcohol or methylated spirit.

**N4418-N4510**

Required tools and measuring instruments:

| | |
|---|---|
| - Head adjusting jig | 4822 403 50718 |
| - Test tape 1 kHz-10 kHz | 4822 397 30014 |
| - Spring pressure gauge 3-55 g | 4822 395 80029 |
| - mV-meter | GM6012 or PM2454B |
| - Dual-beam oscilloscope | PM3230 or PM3130 |
| - LF generator | PM5105 |

SERVICE CS31379

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**Adjusting the head inclination of the record and playback head (Fig. 3)**

Carefully check whether the front of the head is perpendicular to the mounting plate.
Adjust with nut C.

**Adjusting the height of the playback head**

- With adjusting jig
  . Place the jig in the recorder (Fig. 4)
  . The upperside of the uppermost core must be situated exactly under the upperside of the adjusting jig. Adjust with nuts B and C and screw A.
- With test tape
  . Insert the test tape into the recorder
  . Recorder in position: "1-4" - "9.5" - "PLAY"
  . Adjust,with nuts B and C and screw A,the height of the head so that the 1-kHz signal is still just audible above the noise.

Attention:
The nuts B and C and screw A must be equally turned. Otherwise the head inclination would be changed.

**Adjusting the azimuth of the playback head**

- Insert the test tape into the recorder
- Recorder in position "1-4" - "NOR" - "9.5" - "PLAY"
- Adjust with screw A the azimuth of the head so that the reproduction of the 10-kHz signal is maximal. Consequently, the reproduction of the 1-kHz signal may become stronger again. Then the height of the head must be readjusted again.

**Adjusting the head mirror of the playback head**

- Connect a mV-meter to socket MONITOR (point 5)
- Insert the test tape in the recorder
- Recorder in position "1-4" - "NOR" - "9.5" - "PLAY"
- Pull off the pressure felt pad in front of the head. The meter reading may decrease by 1 dB at most. If the deviation should be larger, loosen screw E and turn the head so that the deviation is $\leq 1$ dB.
- Check the azimuth adjustment of the head.

Attention:
When fitting a new head, push it forwards as much as possible.

**Adjusting the head height, the azimuth and the head mirror of the record head**

- Unsolder the wiring from the playback head and resolder it to the record head.
- Connect a mV.meter to socket MONITOR (point 5).
- Insert the test tape into the recorder.
- Recorder in position "1-4" - "NOR" - "9.5" - "PLAY"
- Adjust,with nuts B and C and screw D,the height of the head so that the 1-kHz signal is still just audible above the noise.

Attention:
The nuts B and C and screw D must be equally turned when the height of the head is being adjusted. Otherwise the head inclination would be changed.

- Adjust with screw D the azimuth of the head so that the reproduction of the 10-kHz signal is maximal. Consequently, the reproduction of the 1-kHz signal may become stronger again. The height of the head must then be readjusted.
- Pull off the pressure felt pad in front of the head. The meter reading may decrease by 1 dB at most. If the deviation should be larger, loosen screw F and turn the head so that the deviation is $\leq 1$ dB.
- Check the azimuth adjustment.
- Restore the wiring

**Adjusting the phase difference of the record/playback head**

This adjustment must be carried out only if the other head adjustments have already been checked.
- Connect an LF generator to socket TAPE IN/OUT (points 3/2 and 5/2) and supply a 1-kHz signal.
- Connect a dual beam oscilloscope to socket MONITOR (for example, the output of the right-hand channel (point 5) to the Ya input and the output of the left-hand channel (point 3) to the Yb output).
- Recorder in position: "TAPE" - "A" - "ST" - "19" - "REC" - "PLAY".
- Adjust with screw D the record head so that the two signals are in phase.
- Check the phase difference also at higher frequencies and readjust the record head, if necessary.

**Erase head**

Check whether the surface next to the core gap is smooth. If this surface should have become rough, the erase head must be replaced. Otherwise the tape might be damaged.
A new erase head need not be readjusted. The tape guides of the erase head are a fixed point for the tape transport. Therefore, it is suggested that, after the erase head has been replaced, the tape transport is checked and that, if necessary, the other tape guides are readjusted. Use an adjusting jig for both purposes.

**Pressure felt pads**

Check the condition of the pressure felt pads. If they should have become hard, they must be replaced. Check the pressure force. The force of the felt pad in front of the erase head must be 5...10 g, and is measured at the upper side of bracket 88. When spring 55 is shortened or stretched, the force can be adjusted. The force of the felt pads for the record and playback head must be 20...40 g, and is measured at the upperside of bracket 106. When rings (dia. 2.2 mm) are added under spring 109, the force can be increased; shortening the spring results in an decrease in force. The clearance between the pressure roller bearing bracket and the nuts on pull rod 108 must be about 1.5 mm (pressure roller magnet attracted). Check whether the pull rod can move freely !

**Capstan**

Check the adjustment of the capstan (see Service Manual). A slanting capstan causes a heavy wear of the tape. A slanting position of the capstan is recognised by the stepwise wear of the pressure roller.

**Cleaning**

After the heads have been adjusted or replaced, all tape guides, tape tension comparators, the capstan, the pressure roller, etc. must be carefully cleaned with alcohol or methylated spirit.

**N4450**

Required tools and measuring instruments:

| | |
|---|---|
| - Head adjusting jig | 4822 403 50686 |
| - Test tape 1 kHz - 10 kHz | 4822 397 30014 |
| - Pressure spring gauge 3-5 g | 4822 395 80029 |
| - mV-meter | GM6012 or PM2454B |
| - Dual beam oscilloscope | PM3230 or PM3130 |
| - LF generator | PM5105 |

The record and playback heads of the N4450 can be adjusted in the same way as with the N4418-N4510. However, the record and playback head for left transport and the record and playback head for right transport must be adjusted separately.

## A. Modifications apportées aux appareils

. Version WR09
Sur les appareils portant la marque WR09/243 et les suivants, les résistances suivantes ont été changées:

| | |
|---|---|
| R3/R103 | passe de 5,1 à 6,8 kΩ |
| R4/R104 | passe de 75 kΩ à 100 kΩ |
| R7/R8/R107/R108 | passe de 22 à 7,5 kΩ |
| R9/R109 | passe de 820 à 270 kΩ |

(toutes résistances 1/8 W ± 5 %)
Ces modifications ont été apportées afin d'améliorer la dynamique de l'amplificateur d'enregistrement.

. Sur les appareils portant la marque WR09/303 et les suivants, les comparateurs de tension de bande 84 sont pourvus d'amortisseurs. Ceux-ci se composent de deux disques en plastique entre lesquels il a été inséré du liquide silicone. Pour ce qui est des numéros de code des nouvelles pièces et de l'ordre de succession du montage, voir fig. 1.
Attention:
Les deux disques en plastique sont pourvus de ce liquide silicone à l'usine et sont pressés de façon spéciale.
Ces disques ne doivent absolument pas être séparés pendant le montage.

. Sur les appareils portant la marque WR09/304 et les suivants, la résistance R202 (2,2 kΩ - 1/8 W ± 5 %) a été insérée (voir fig. 2). Cette transformation est allée de pair avec le remplacement des diodes D10 et D11 de type BZX88/C3V3 de l'unité RESET/AUTOMATIC REVERSE P201, par des diodes BZX79/C4V7. Cette transformation a été apportée parce que l'appareil s'arrêtait brusquement et sans raison apparente à l'usage de la télécommande N6719.

. Sur les appareils portant la marque WR09/304 et les suivants, les bobines L701, L702, L703 et L704 et les condensateurs C704 et C703 sont supprimés. Sur les appareils marqués WR09/309 et les suivants, les condensateurs sont à nouveau montés afin d'éviter les crachements de moteur.

. Sur les appareils portant la marque WR09/309 et les suivants, la résistance R39 est passée de 560 Ω à 1,5 kΩ (résistance de sécurité - 4822 110 63112) et le condensateur C14, de 220 µF à 220 µF - 16 V (4822 124 20473). Du fait que C14 en est réduit, la paroi 176 ne cogne plus le condensateur.

. Sur les appareils portant la marque WR09/309 et les suivants, les modifications suivantes ont été apportées sur la platine 1 (voir fig. 3):
- les surfaces de connexion pour le soudage des douilles de contact ont été agrandies;
- les supports de lampes sont supprimés parce que les fils des lampes sont soudés directement sur la platine.

. Sur les appareils portant la marque WR09/311 et les suivants, il a été monté une paroi d'isolation entre le commutateur SK5 et l'unité P10 (PRE-EMPHASIS/SPEED SELECTOR UNIT). Cette modification a été apportée afin d'éviter la diaphonie des pistes 3 et 1.

. Sur les appareils portant la marque WR09/323 et les suivants, les modifications suivantes ont été faites sur la platine 2 (voir fig. 2):
- trace imprimée
- les diodes D277, 278, 279, 280, 281, 282 et les résistances R232, 233, 234 seront montées côté composants de la platine.

. Version WR10
Sur les appareils portant la marque WR10/334 et les suivants, le transistor TS201 - 2SC931 - est remplacé par un BD437. Numéro de code: 4822 130 40982.
N.B.:
Le Service fournit momentanément sous le numéro 4822 130 40899 le transistor D330D8D, qui peut aussi être utilisé à la place du 2SC931.

. Sur les appareils portant la marque WR10/334 et les suivants, la gamme de fréquence est passée de 20.000 Hz à 25.000 Hz à 19 cm/sec. A cet effet, les unités PLAY-BACK et PRE-EMPHASIS/SPEED SELECTOR ont été adaptées. Les nouvelles unités sont livrables sous les numéros suivants:
- PLAY-BACK UNIT: 4822 218 30152
- PRE-EMPHASIS/SPEED SELECTOR UNIT 4822 218 30153

. Version WR11
Sur les appareils portant la marque WR11/335 et les suivants, les plateaux à bobine sont pourvus d'un anneau-guide en caoutchouc et d'un ressort de terre afin de dévier la charge statique. Les nouveaux plateaux à bobine peuvent être montés au lieu des anciens. Numéro de code: 4822 528 10293.

## B. Complément à la Notice Technique

. Méthode de réglage de l'unité RECORDING P4/P104 modifiée:

Magnétophone
en position : enregistrement-"TAPE"-"B"-"ST"-"NOR"-"9,5"
commande d'enregistrement "REC" au maximum
autres commandes au minimum

| | | |
|---|---|---|
| Entrée: | BU2 TAPE IN/OUT 3/2 | 333 Hz - 0,1 V |
| Sortie: | BU5 MONITOR 3/2 | régler sur 1 V avec R4 sur P5 |
| Entrée: | BU2 TAPE IN/OUT 5/2 | 333 Hz - 0,1 V |
| Sortie: | BU5 MONITOR 5/2 | régler sur 1 V avec R4 sur P105 |
| Entrée: | BU2 TAPE IN/OUT 5/2 | 333 Hz - 1 V |
| Sortie: | BU5 MONITOR 5/2 | régler avec la commande d'enregistrement "REC" sur 1 V |
| Entrée: | BU2 TAPE IN/OUT 3/2 | 333 Hz - 1 V |
| Sortie: | BU5 MONITOR 3/2 | valeur à mesurer 1 V ± x V (x = max. 0,8 V). Diviser en deux la différence par rapport à 1 V avec R4 sur P5. |
| Sortie: | BU4 PHONO 6/2 (MP1) | régler sur 1,5 mV avec R9 sur P4 |
| Entrée: | BU2 TAPE IN/OUT 5/2 | 333 Hz - 1 V |
| Sortie: | BU5 MONITOR 5/2 | valeur à mesurer 1 V ± y V (y = max. 0,8 V). Diviser en deux la différence par rapport à 1 V avec R4 sur P105. Si par la suite on obtient $\frac{x}{2} \neq \frac{y}{2}$ diviser de nouveau en deux la tension de différence par rapport à 1 V |
| Sortie: | BU4 PHONO 7/2 (MP101) | Régler sur 1,5 mV avec R9 sur P104 |

Attention:
Afin d'éviter que la tension de prémagnétisation ne soit aussi mesurée, enlever l'unité d'oscillateur P9.

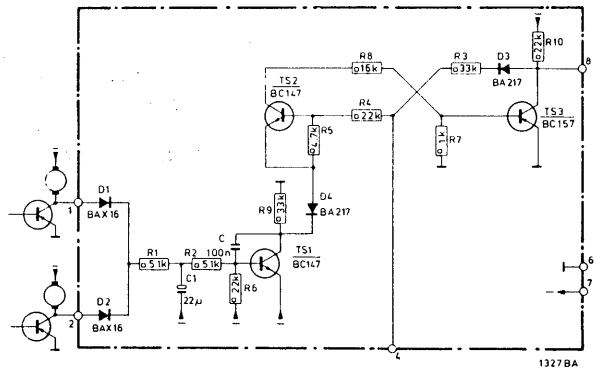
. Correction du réglage du courant de prémagnétisation
Le commutateur SK3 "B-A" doit se trouver en position "A" pour ce réglage.

. Dans certains cas, il peut arriver que le champ de l'anneau aimanté monté sur la poulie du moteur de cabestan M3, se réduise. Ceci pourra être constaté en mesurant la tension de sortie de la tête K4. On trouvera ci-dessous une table donnant ces tensions aux différentes vitesses.

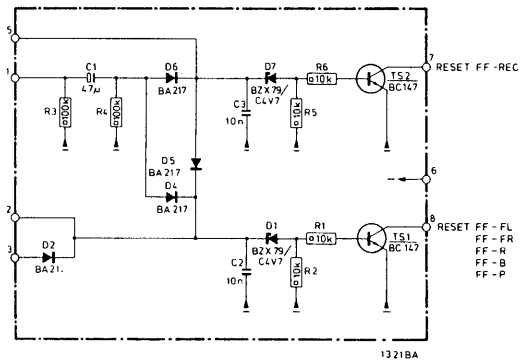
| Vitesse | Tension de sortie K4 |
|---|---|
| 4,75 cm/sec | 54 mV |
| 9,5 cm/sec | 110 mV |
| 19 cm/sec | 175 mV |

. Dans la partie I de la Notice Technique, il est donné l'impression dans la description de l'étage de sortie, que ce circuit est protégé contre les court-circuits de la sortie. L'étage de sortie n'est en fait protégé que contre la panne résultant de signaux d'entrée trop élevés.

| MOTOR STOP UNIT | N4418, N4510 |
|---|---|




| RECORDER STOP UNIT | N4418, N4510 |
|---|---|



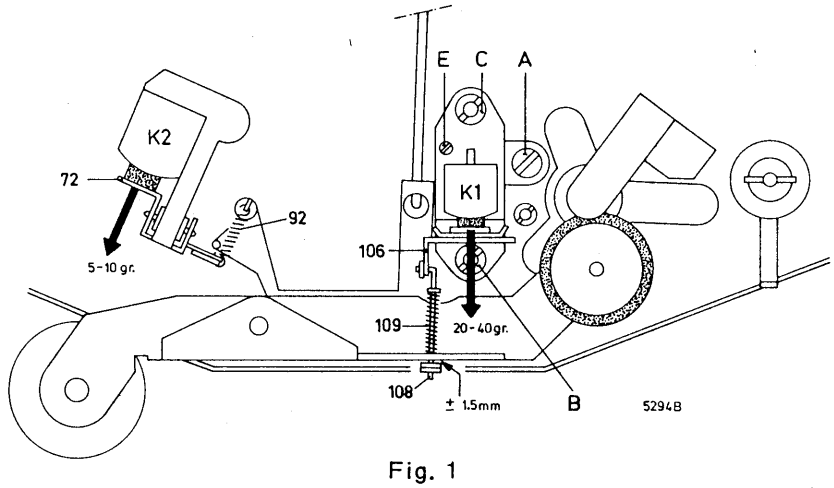



Fig. 1

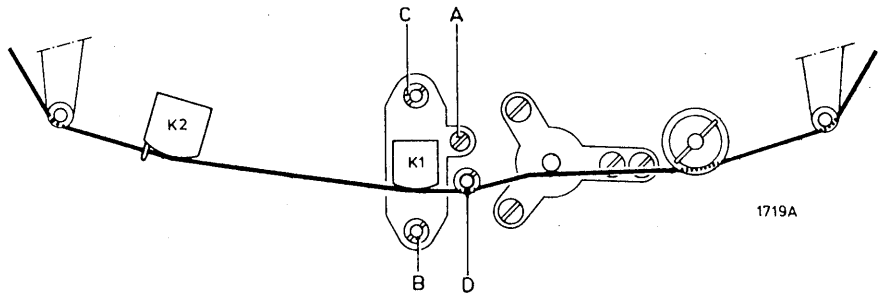



Fig. 2

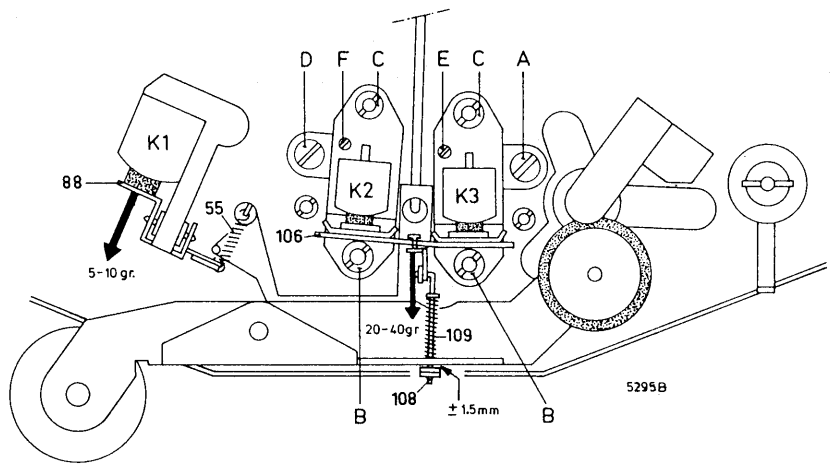



Fig. 3

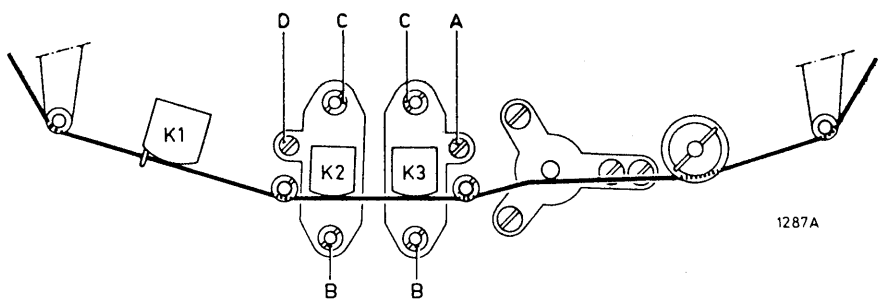



Fig. 4

# Service Information

1975-10-23

REEL - to REEL RECORDERS

AR 75-13

Concerning: Replacing the heads.

The heads 4822 249 10057 and 4822 249 20032 may be replaced by the heads 4822 249 10085 and 4822 249 20037 respectively, which are of the long-life type.

However, when the replacement types are used, the bias current adjustment is more critical. The approximate value of the bias current,when long-life heads are used, is 4 dB lower than when mu-metal heads are employed. Anyhow, a compromise between the frequency response and distortion must be found:

- If there are too few treble tones and if distortion is too great, the bias current must be reduced.
- If there are too many treble tones and if distortion should be too great, the bias current must be increased.

Distortion must not exceed 3 %.

---

Betreft: Vervangen van koppen.

De koppen 4822 249 10057 en 4822 249 20032 kunnen worden vervangen door de koppen 4822 249 10085 resp. 4822 249 20037.
Deze laatste zijn van het "long-life" type.

Bij vervangen is het instellen van de voormagnetisatiestroom kritischer. De richtwaarde van de voormagnetisatiestroom bij "long-life" koppen is 4 dB lager dan bij "mu-metalen" koppen.
In alle gevallen geldt een kompromis tussen de frekwentie-karakteristiek en de vervorming:

- Bij te weinig hoge tonen en te grote vervorming moet de voormagnetisatiestroom verlaagd worden.
- Bij te veel lage tonen en te grote vervorming moet de voormagnetisatiestroom verhoogd worden.

De vervorming moet kleiner dan 3 % zijn.

---

Concernant: Remplacement de têtes.

Les têtes 4822 249 10057 et 4822 249 20032 peuvent être remplacées par, respectivement, les têtes 4822 249 10085 ou 4822 249 20037; ces dernières étant de type "long-life".

Lors du remplacement le réglage du courant de prémagnétisation est plus critique. La valeur d'orientation pour le courant de pré-magnétisation avec des têtes de type "long-life" est inférieure de 4 dB à celle avec têtes au $\mu$-métal. Dans les deux cas, un compromis entre la courbe de fréquence et la distortion doit être trouvé:

- En présence d'un manque de tous aigus et de trop de distortion, le courant de prémagnétisation doit être réduit
- En présence de trop d'aigus et d'une trop forte distortion, le courant de pré-magnétisation devra être baissé.

La distortion doit être inférieure à 3 %.

---

Betrift: Ersetzen der Köpfe.

Die Köpfe 4822 249 10057 und 4822 249 20032 darf man durch die Köpfe 4822 249 10085 bzw. 4822 249 20037 ersetzen. Die Ersatz-Köpfe sind vom "long-life" Typ.

Beim Ersetzen ist zu berücksichtigen, dass das Einstellen des Vormagnetisierungs-stromes kritischer ist. Der Dichtwert des Vormagnetisierungs-stromes ist bei "long-life" Köpfen um ca 4 dB niedriger als bei Mu-Metall-Köpfen. Es ist jedenfalls ein Kompromiss zwischen dem Frequenzgang und der Verformung anzustreben:

- Bei zu wenig hohen Tönen und zu grosser Verformung ist der Vormagnetisierungs-strom zu erniedrigen.
- Bei zu viel hohen Tönen und zu grosser Verformung ist die Vormagnetisierungs-strom zu erhöhen.

Die Verformung soll geringer als 3 % sein.

---

SERVICE

CS53898

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ES LIMITED

AMENDMENTS AND ADDITIONS TO N4450 SERVICE MANUAL

REVISED CIRCUIT DIAGRAM, CABINET AND MECHANICAL EXPLODED VIEWS

During production several changes have been made to the N4450 tape recorder, details of which are given in the following paragraphs.

Models bearing Factory Code WR04-144 and onwards

Pulleys 55 are secured by means of 2 Allen screws 3mm x 8mm (Item 4). For code number see spare parts list.

Models bearing Factory Code WR05-147 and onwards

In order to extend the life of the lamps, safety resistors R43, R44, R45, R46 180Ω have been added in series with lamps LA1, LA2, LA3, LA4 respectively.

In addition the values of safety resistors R47 and R48 have been changed from 22Ω to 120Ω.

For code numbers of safety resistors see spare parts list.

Models bearing Factory Code WR06-147 and onwards

An 80mA fuse was added in series with timer motor M4, and this fuse continued in use until version WR08-206 appeared, at which time the fuse was changed to 250mA-T. For code number see spare parts list.

Model bearing Factory Code WR07 and onwards

In recorders marked -149 serial number 4600 and onwards transistors type 16-175 (2N6107) were introduced to control the winding motors. For code number see spare parts list.

Models marked -150 and onward had a recess made to the right of bracket 540 in order that bracket 550 might be adjustable. The adjustment was necessary in cases when switch SK9 (Fast-Med-Slow) failed to operate.

Models bearing Factory Code WR08 and onwards

Recorders marked -203 and onward incorporate the following changes.

(a) The screws (11) securing the capstan motor 173 to bracket 531 have been sealed with locking paint.

(b) Ornamental frame 180 is fitted with 10 retaining screws rather than six. The code number of the 10 hole frame 180 remains the same i.e. 460.20067.

(c) To prevent a grinding sound when the recorder is tilted forward, a washer (200) was fitted between each flywheel 95 and capstan bearing 88. Washer code number 532.50301.

(d) The lower part of ornamental cover 136 can be fixed in position when opened.

Cover 136 complete with closing bracket 140 continues with the same code number i.e. 443.20071.

Closing bracket 140 code number 403.50738.

/Cont'd....

(e) In this model fuse Z701 in series with motor M4 changed from 80mA to 250mA-T. (See models bearing Factory Code WR06-147).

Models bearing Factory Code WR09 and onwards

In versions coded -210 onwards head adjusting screws 96 have finer threads to facilitate precise adjustments of the heads.

In versions coded -227 onwards thermal conduction between TS701/702 and their mounting plate has been improved by means of silicone paste.

In versions coded -238 (serial number 6001) onwards on extra bracket 542 has been fitted to prevent movement of oil seals 87.

## MULTI-WAY CONNECTORS

The various functional units are connected to printed circuit boards 1 and 2 via multi-way connectors with provision for a total of 3,8 or 14 contacts. As the circuits of the units vary, different combinations of pin arrangements are required on many connectors.

For servicing purposes, only 3 types of connector will be supplied, 3, 8, and 14 pole versions each complete with a full set of connecting pins.

Un-necessary contacts should be removed before fitting.

## SPARE PARTS LIST

(Additions and Amendments only)

MECHANICAL PARTS

| Item | | |
|---|---|---|
| 2 | Screw 3mm x 4mm | 502.11069 |
| 4 | Screw 3mm x 8mm | 502.10174 |
| 5 | Nut 5mm | 505.10513 |
| 8 | Washer 3.2 x 7 x 0.3mm | 532.50298 |
| 9 | Washer 4.2 x 8 x 0.5mm | 532.10333 |
| 14 | Washer 3.2 x 6 x 0.4mm | 530.80082 |
| 17 | Washer 3.2 x 9 x 0.8mm | 532.10582 |
| 24 | Circlip | 530.70116 |
| 25 | Washer 3.2 x 7 x 0.5mm | 532.10332 |
| 26 | Screw 3 x 4mm | 502.11189 |
| 27 | Washer | 532.10332 |
| 29 | Washer 3.2 x 4.5 x 0.3 | 532.50938 |
| 32 | Screw 3 x 20mm | 502.11096 |
| 33 | Spacer 3.1 x 16 x 5mm | 532.20607 |
| 35 | Screw 2 x 8mm | 502.10681 |
| 47 | Screw 4 x 8mm | 502.10693 |
| 49 | Washer 4.2 x 8 x 0.1mm | 532.10479 |

/Cont'd....

| Item | | |
|---|---|---|
| 50 | Washer 3.2 x 8 x 0.2mm | 532.50298 |
| 57 | Belt | 358.30145 |
| 60 | Bearing | 502.10765 |
| 71 | Washer | 532.30266 |
| 79 | Belt | 358.30045 |
| 96 | Screw | 502.10665 |
| 97 | Screw 3mm | 502.11217 |
| 98 | Nut 3mm | 505.10408 |
| 104 | Pressure spring | 492.50925 |
| 105 | Bearing | 535.70468 |
| 110 | Grommet | 528.80545 |
| 200 | Washer 5.2 x 9 x 0.5mm | 532.50301 |
| 201 | Screw 3 x 8mm | 502.11053 |
| 202 | Washer 3.6 x 12 x 1mm | 532.10489 |
| 203 | Washer | 532.50786 |
| 204 | Tension spring | 492.30355 |
| 205 | Belt damper | 479.30045 |

CABINET AND AMPLIFIER

| Item | | |
|---|---|---|
| 3 | Washer | 532.50725 |
| 15 | Nut 3mm | 505.10325 |
| 39 | Screw 4 x 30mm | 502.10053 |
| 40 | Screw 3mm | 502.11287 |
| 41 | Screw 3.9 x 9.13mm | 502.30006 |
| 43 | Screw 4 x 22mm | 502.10051 |
| 44 | Screw (self-tapping) 2.9 x 15mm | 502.30048 |
| 45 | Screw (self-tapping) 2.9 x 4.37mm | 502.30065 |
| 118 | Support | 325.20063 |
| 131 | Hinge | 417.10516 |
| 139 | Meter ME101 | 347.10069 |
| 140 | Bracket | 403.50738 |
| 141 | Meter ME1 | 347.10071 |
| 149 | Socket cover plate | 459.80039 |
| 151 | Ball 5/32" | 520.40012 |
| 154 | Pin | 535.90912 |
| | Ball for switch SK5 | 535.90913 |
| 155 | Pressure spring | 492.50927 |
| | Pressure spring for switch Fast-Med-Slow | 492.51037 |
| 187 | Screw 3 x 4mm | 502.10663 |
| 190 | Lens | 381.10401 |
| 191 | Lamp holder | 256.90135 |

ELECTRICAL MISCELLANEOUS

(a) Control section

| | |
|---|---|
| Switch SK8 (NOR-REV) | 277.30378 |
| Switch 702 (Counter) | 278.90231 |
| Plug for BU201 | 264.50043 |
| TS201 Transistor 2SC931 | 130.40899 |
| TS701 ) Transistor 16-175 (2N6107)<br>TS702 ) | 130.40903 |
| Lamp holder for LA601 - LA606 | 401.10561 |

/Cont'd....

(b) Supply

| | | |
|---|---|---|
| Switch SK105 Voltage adaptor | | 272.10202 |
| Lamp LA8/9 19V-50mA (timer) | | 134.40078 |
| Lamp-holder for LA1 - LA4 | | 256.90135 |
| Lamp-holder for LA701, 702 | | 401.10561 |
| Holder for fuses Z501,502 | | 492.60063 |
| Holder for fuse Z701 | | 256.30128 |
| Fuse Z701 250mA-T | | 253.30013 |

Safety Resistors

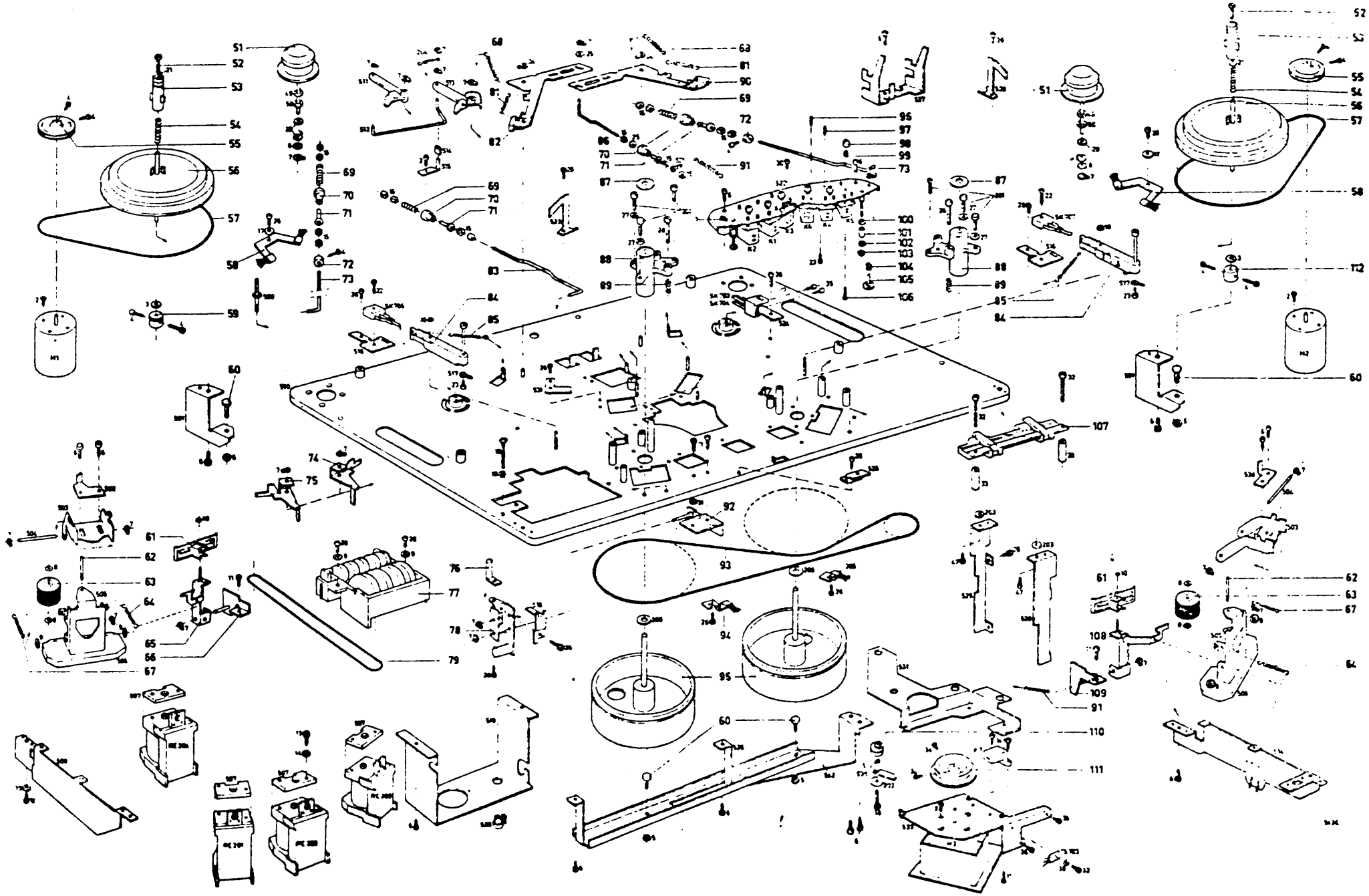
| | | |
|---|---|---|
| R35 | 10kΩ | 110.53134 |
| R36,R132 | 68 Ω | 110.53076 |
| R37 | 330Ω | 110.43094 |
| R38 | 820Ω | 111.30424 |
| R39 | 560Ω | 111.30374 |
| R40 | 1k Ω | 111.30404 |
| R41 | 3k3Ω | 111.30413 |
| R42 | 3k Ω | 111.30442 |
| R47,R48 | 120Ω | 111.50135 |
| R43,R44,R45 | | |
| R46,R133,R134 | 180Ω | 110.43087 |
| R502 | 33Ω | 111.30418 |

(c) Amplifier

| | | |
|---|---|---|
| Switches SK703,704 | | 278.90232 |
| Contact spring for BU8 - BU10 (signal) | | 268.20032 |
| Contact spring for BU8 - BU10 (earth) | | 492.61313 |
| Plug for BU1 - BU5, and BU8 - BU10 | | 264.40023 |
| Plug for BU6, BU7 | | 264.30041 |
| Plug for BU11 | | 264.40092 |
| Adjusting core for L301 - L304 | | 526.10014 |
| Plug on multiple cable 14 pole | | 264.50079 |
| C13 | 150uF - 25V | 124.20388 |
| C508 | 330uF - 63V | 124.20404 |
| C705 | 1000uF - 63V | 124.70215 |

Safety Resistors

| | | |
|---|---|---|
| R15, R115 | 20Ω | 111.50372 |



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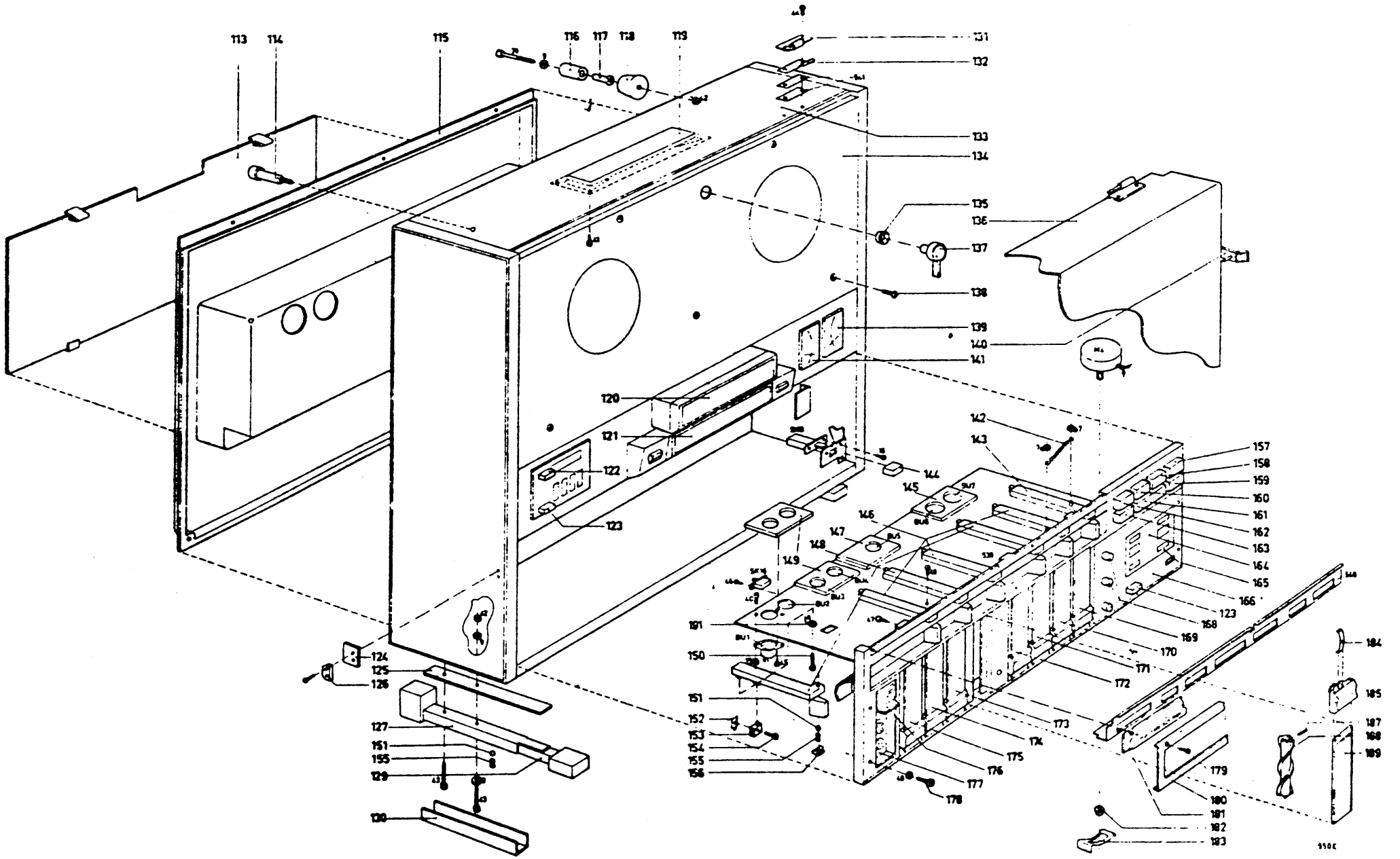
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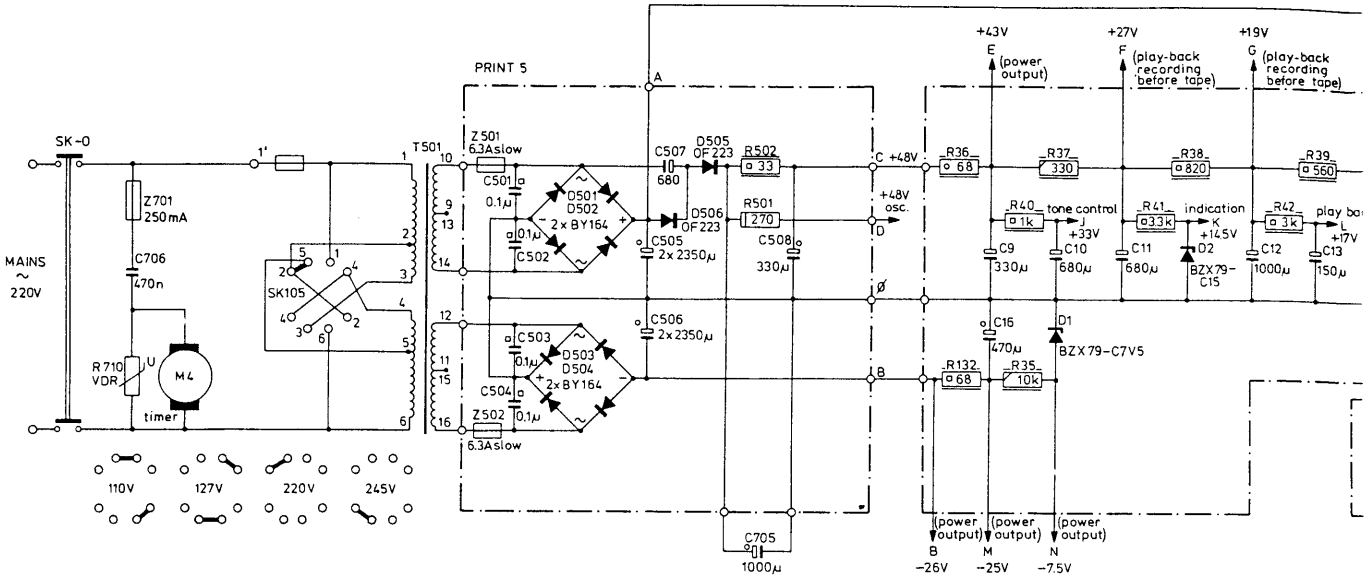
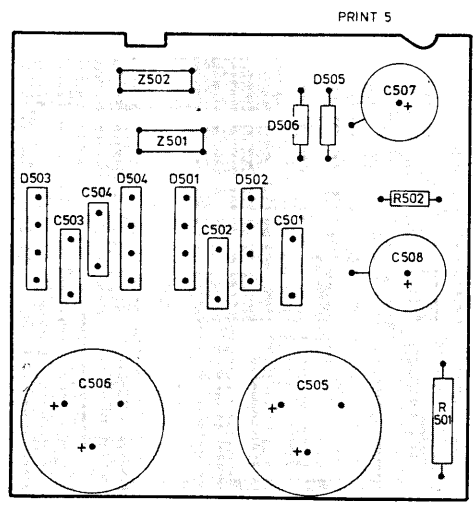
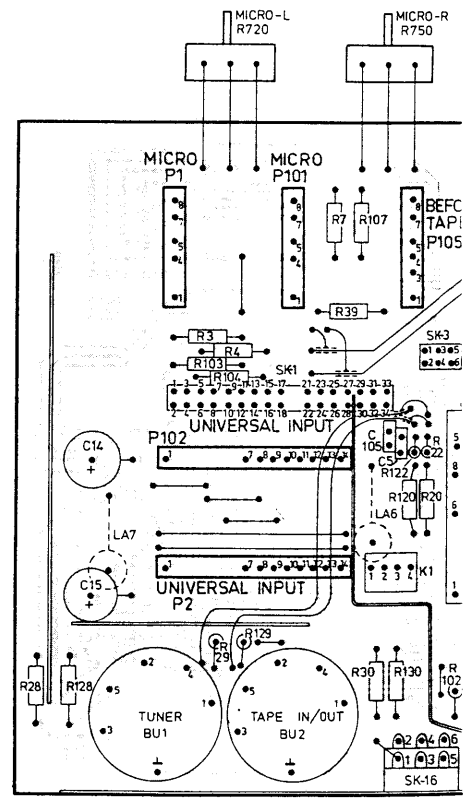
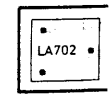
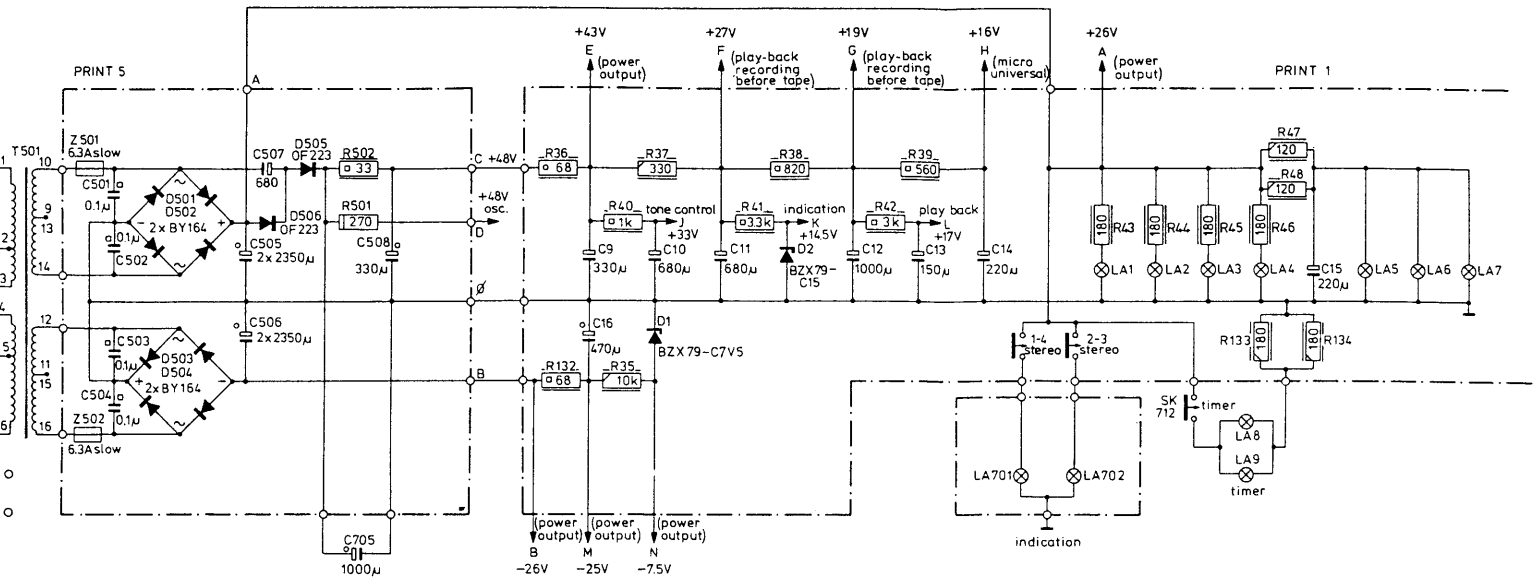
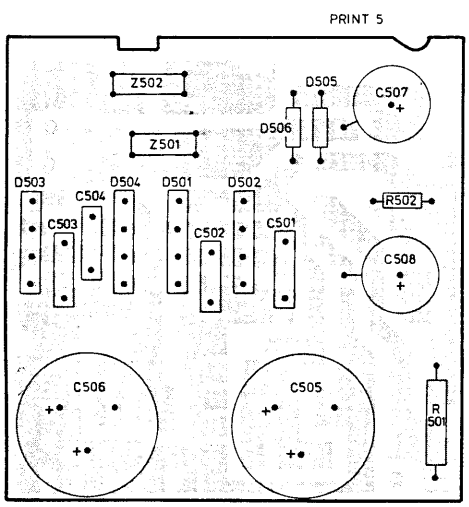

PRINT 5
SK-0
MAINS ~ 220V
Z701 250mA
C706 470n
R710 VDR
M4
timer
SK105
T501
110V
127V
220V
245V
Z501 6.3Aslow
C501 0.1µ
C502 0.1µ
D501 D502 2x BY164
C503 0.1µ
C504 0.1µ
D503 D504 2x BY164
Z502 6.3Aslow
C507 680
D505 OF 223
D506 OF 223
C505 2x 2350µ
C506 2x 2350µ
R502 33
R501 270
C508 330µ
C705 1000µ
+48V osc.
C +48V
D
B
A
+43V
E (power output)
+27V
F (play-back recording before tape)
+19V
G (play-back recording before tape)
R36 68
R37 330
R38 820
R39 560
R40 1k
tone control
+33V
R41 33k
indication
+14.5V
R42 3k
play ba
+17V
C9 330µ
C10 680µ
C11 680µ
D2 BZX79-C15
C12 1000µ
C13 150µ
C16 470µ
D1 BZX79-C7V5
R132 68
R35 10k
(power output) B −26V
(power output) M −25V
(power output) N −7.5V

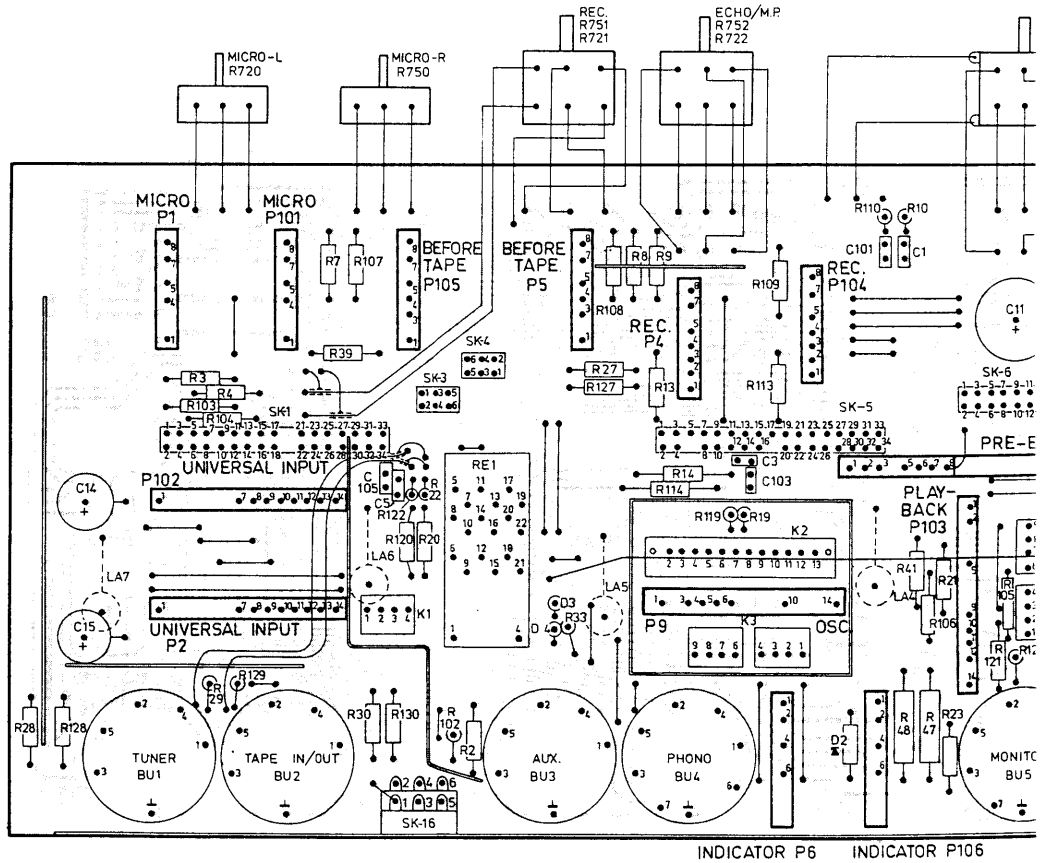

PRINT 5
Z502
Z501
D503
C504
D504
D501
D502
C503
C502
C501
D505
D506
C507
R502
C508
C506
C505
R 501

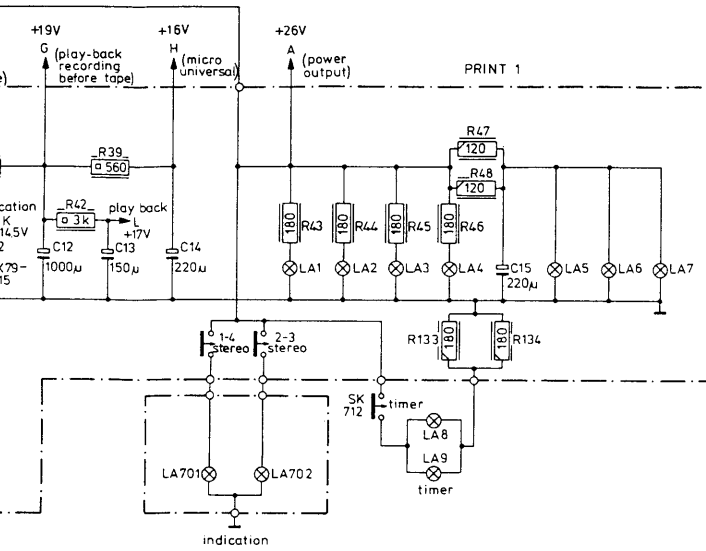

MICRO-L R720
MICRO-R R750
MICRO P1
MICRO P101
R7
R107
R39
SK-3
R3
R4
R103
R104
SK1
UNIVERSAL INPUT P102
C14
C15
LA7
UNIVERSAL INPUT P2
R129
R28
R128
TUNER BU1
TAPE IN/OUT BU2
R30
R130
SK-16
K1
LA6
R120
R20
R122

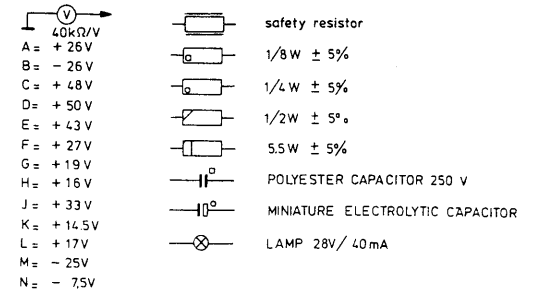

LA702

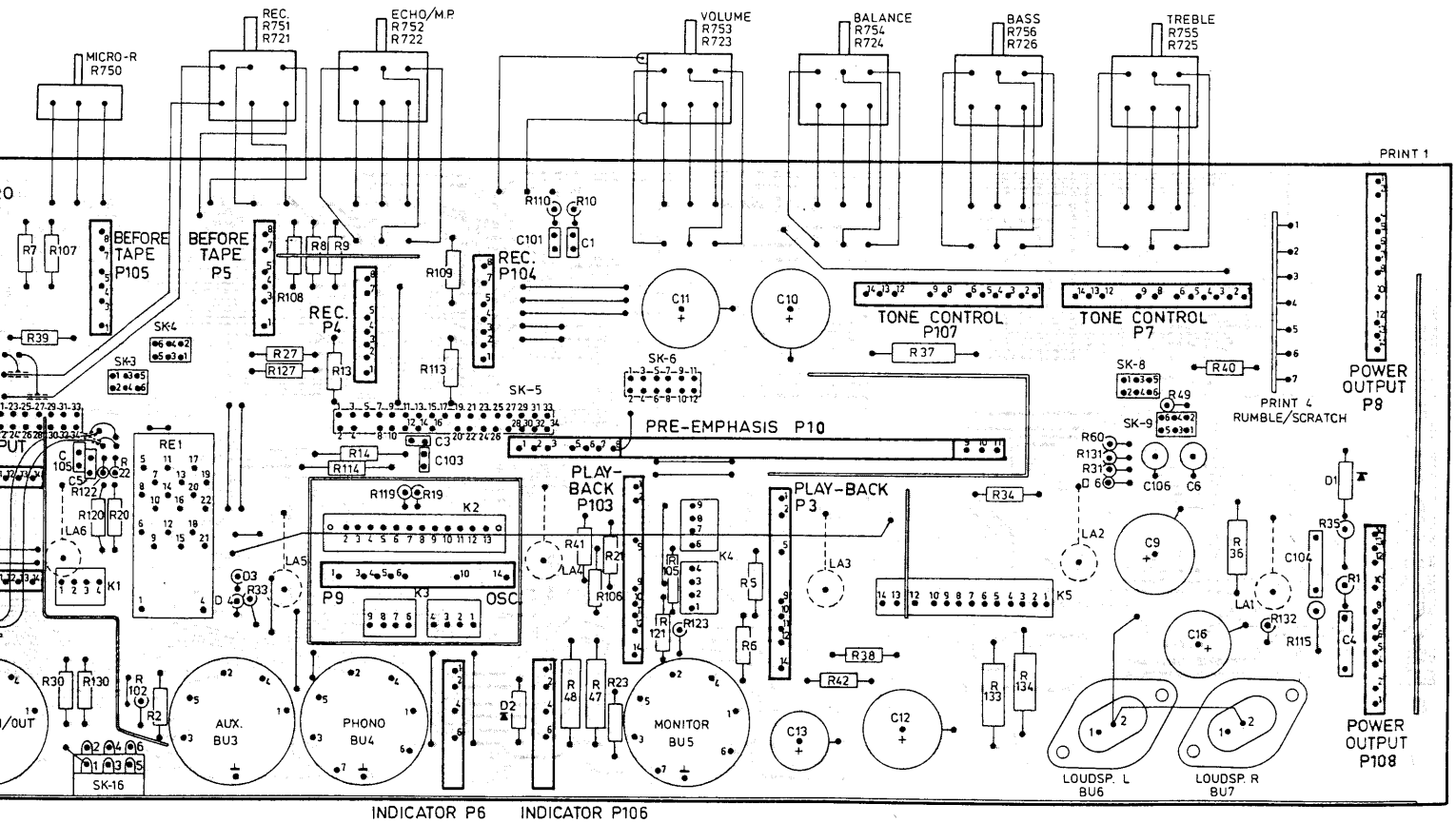

PRINT 5
PRINT 1
T501
Z501 6.3Aslow
C501 0.1µ
C502 0.1µ
D501 D502 2x BY164
C503 0.1µ
C504 0.1µ
D503 D504 2x BY164
Z502 6.3Aslow
C507 680
D505 OF223
D506 OF223
R502 33
R501 270
C505 2x 2350µ
C506 2x 2350µ
C508 330µ
C705 1000µ
+48V osc.
+43V
+27V
+19V
+16V
+26V
(power output)
(play-back recording before tape)
(play-back recording before tape)
(micro universal)
(power output)
R36 68
R37 330
R38 820
R39 560
R40 1k
tone control
R41 3.3k
indication
R42 3k
play back
C9 330µ
C10 680µ
C11 680µ
C12 1000µ
C13 150µ
C14 220µ
D2 BZX79-C15
C16 470µ
D1 BZX79-C7V5
R132 68
R35 10k
R47 120
R48 120
R43 180
R44 180
R45 180
R46 180
LA1
LA2
LA3
LA4
C15 220µ
LA5
LA6
LA7
R133 180
R134 180
1-4 stereo
2-3 stereo
SK 712 timer
LA8
LA9
timer
LA701
LA702
indication
(power output) B −26V
(power output) M −25V
(power output) N −7.5V

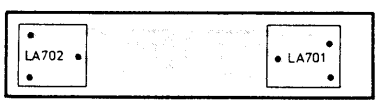

PRINT 5
Z502
Z501
D505
C507
D506
D503
C504
D504
D501
D502
C503
C502
C501
R502
C508
C506
C505
R 501


MICRO-L R720
MICRO-R R750
REC. R751 R721
ECHO/M.P R752 R722
MICRO P1
MICRO P101
BEFORE TAPE P105
BEFORE TAPE P5
REC. P4
REC. P104
UNIVERSAL INPUT P102
UNIVERSAL INPUT P2
PLAY-BACK P103
P9
OSC
K1
K2
K3
SK-1
SK-3
SK-4
SK-5
SK-6
SK-16
RE1
LA5
LA6
LA7
TUNER BU1
TAPE IN/OUT BU2
AUX. BU3
PHONO BU4
INDICATOR P6
INDICATOR P106
LA702
LA701



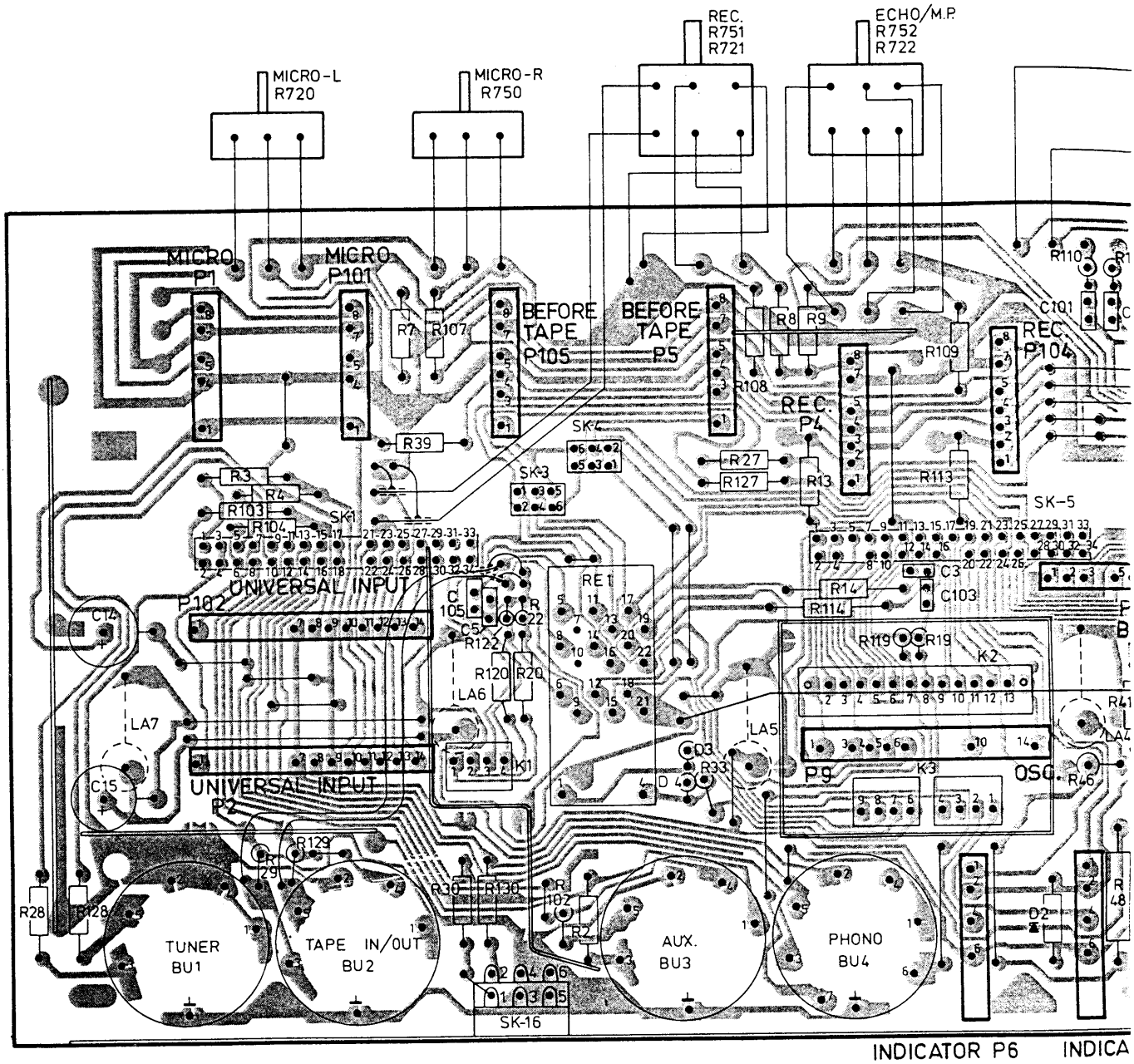




585FA

CS36288


MICRO-L
R720
MICRO-R
R750
REC.
R751
R721
ECHO/M.P.
R752
R722
MICRO
P1
MICRO
P101
BEFORE
TAPE
P105
BEFORE
TAPE
P5
REC.
P4
REC.
P104
SK-5
UNIVERSAL INPUT
P102
UNIVERSAL INPUT
P2
TUNER
BU1
TAPE IN/OUT
BU2
AUX.
BU3
PHONO
BU4
SK-16
INDICATOR P6
INDICA

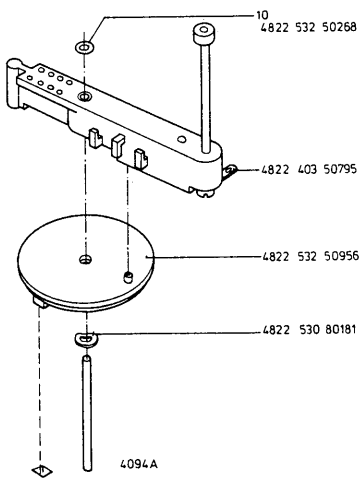

10
4822 532 50268
4822 403 50795
4822 532 50956
4822 530 80181
4094A

Fig. 1

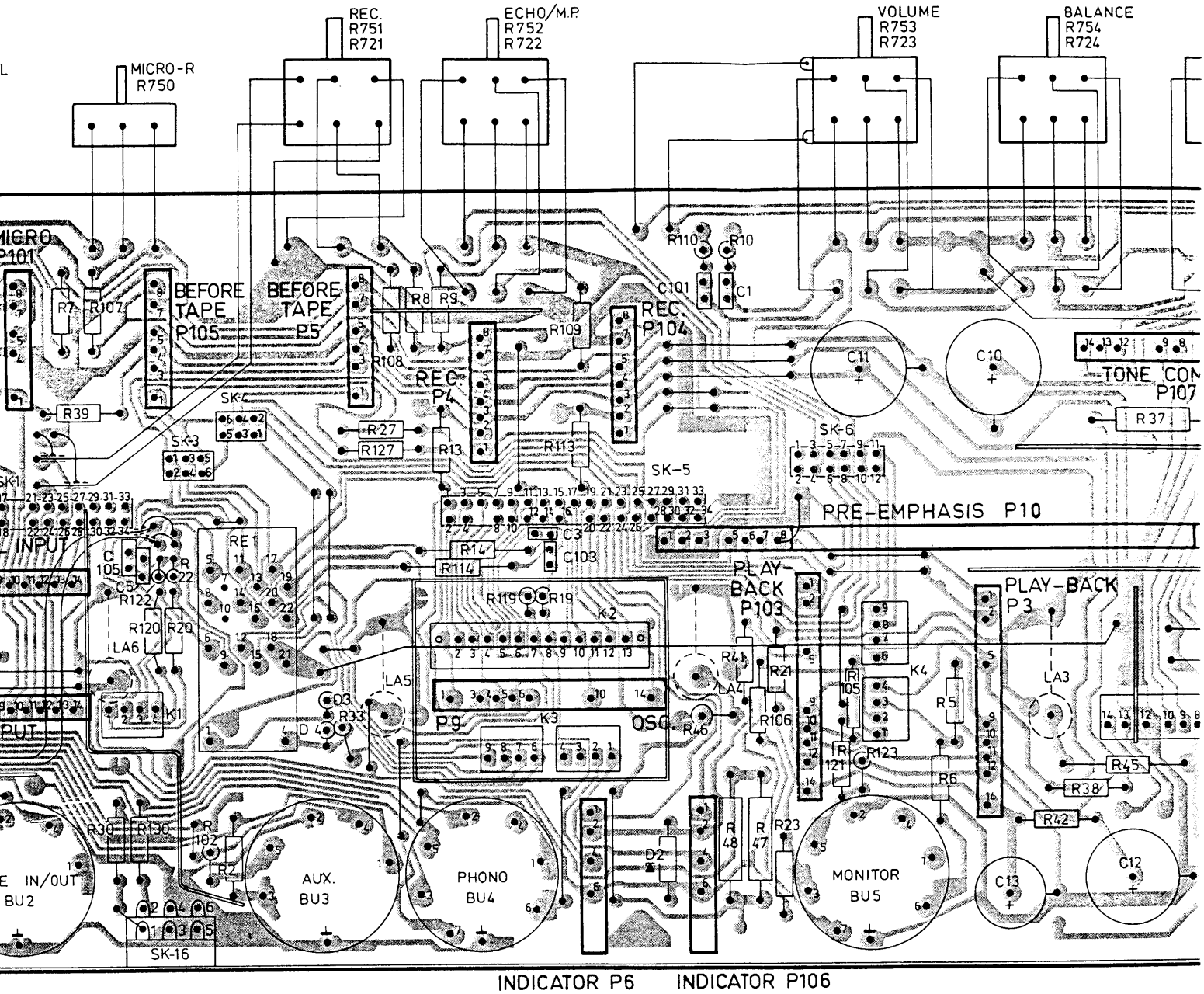

REC.
R751
R721
ECHO/M.P.
R752
R722
VOLUME
R753
R723
BALANCE
R754
R724
MICRO-R
R750
BEFORE
TAPE
P105
BEFORE
TAPE
P5
REC.
P4
REC.
P104
TONE CON
P107
PRE-EMPHASIS P10
PLAY-
BACK
P103
PLAY-BACK
P3
INPUT
AUX.
BU3
PHONO
BU4
MONITOR
BU5
IN/OUT
BU2
SK-16
INDICATOR P6
INDICATOR P106

Fig. 3

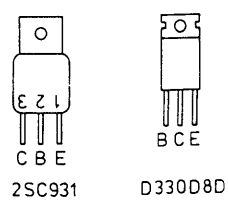

C B E
2SC931
B C E
D330D8D

Fig. 4

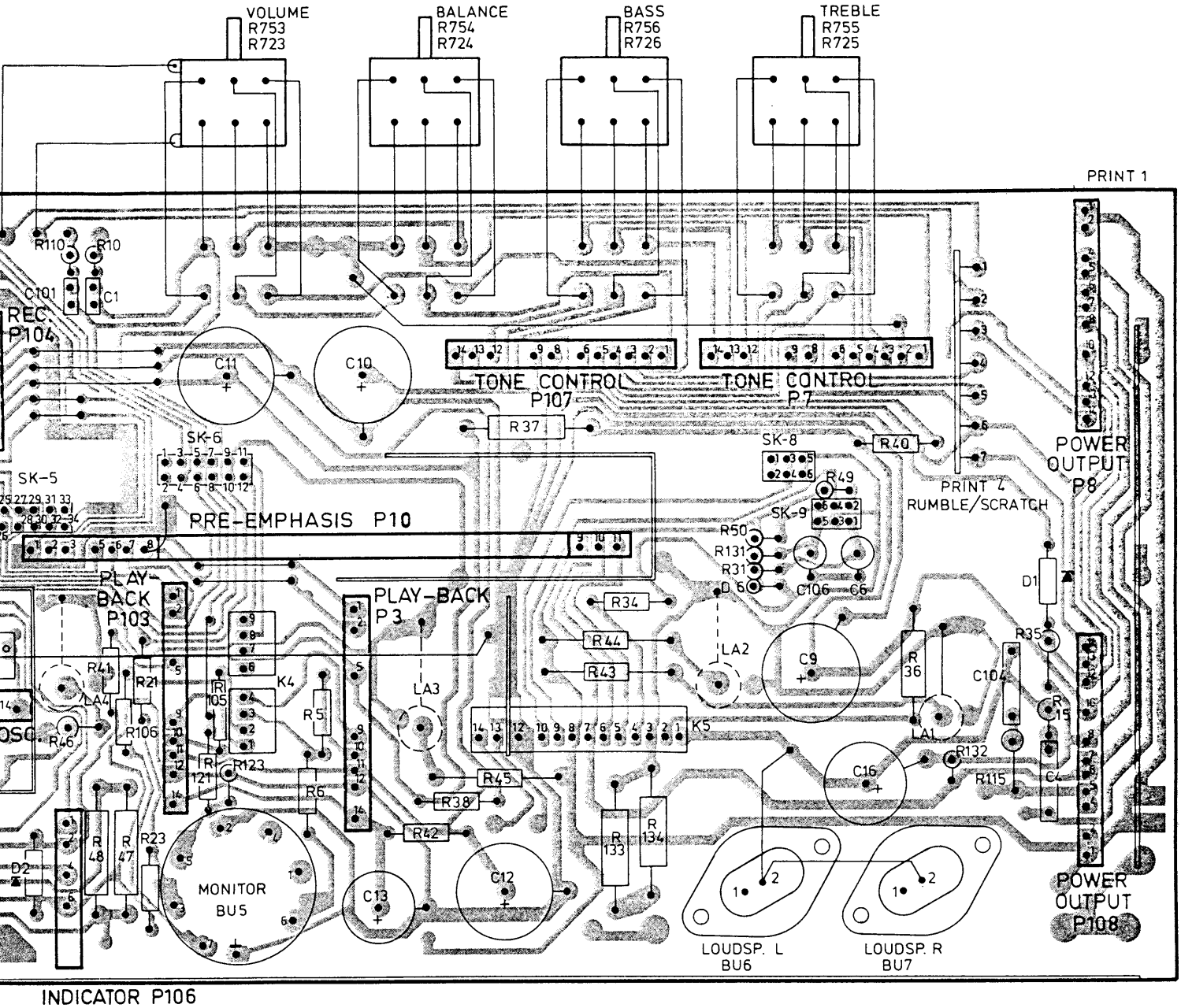

VOLUME
R753
R723
BALANCE
R754
R724
BASS
R756
R726
TREBLE
R755
R725
PRINT 1
REC.
P104
TONE CONTROL
P107
TONE CONTROL
P7
POWER
OUTPUT
P8
PRINT 4
RUMBLE/SCRATCH
PRE-EMPHASIS P10
PLAY-
BACK
P103
PLAY-BACK
P3
MONITOR
BU5
LOUDSP. L
BU6
LOUDSP. R
BU7
POWER
OUTPUT
P108
INDICATOR P106
585FB

Fig. 3

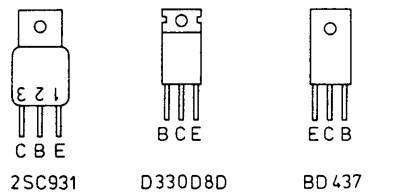
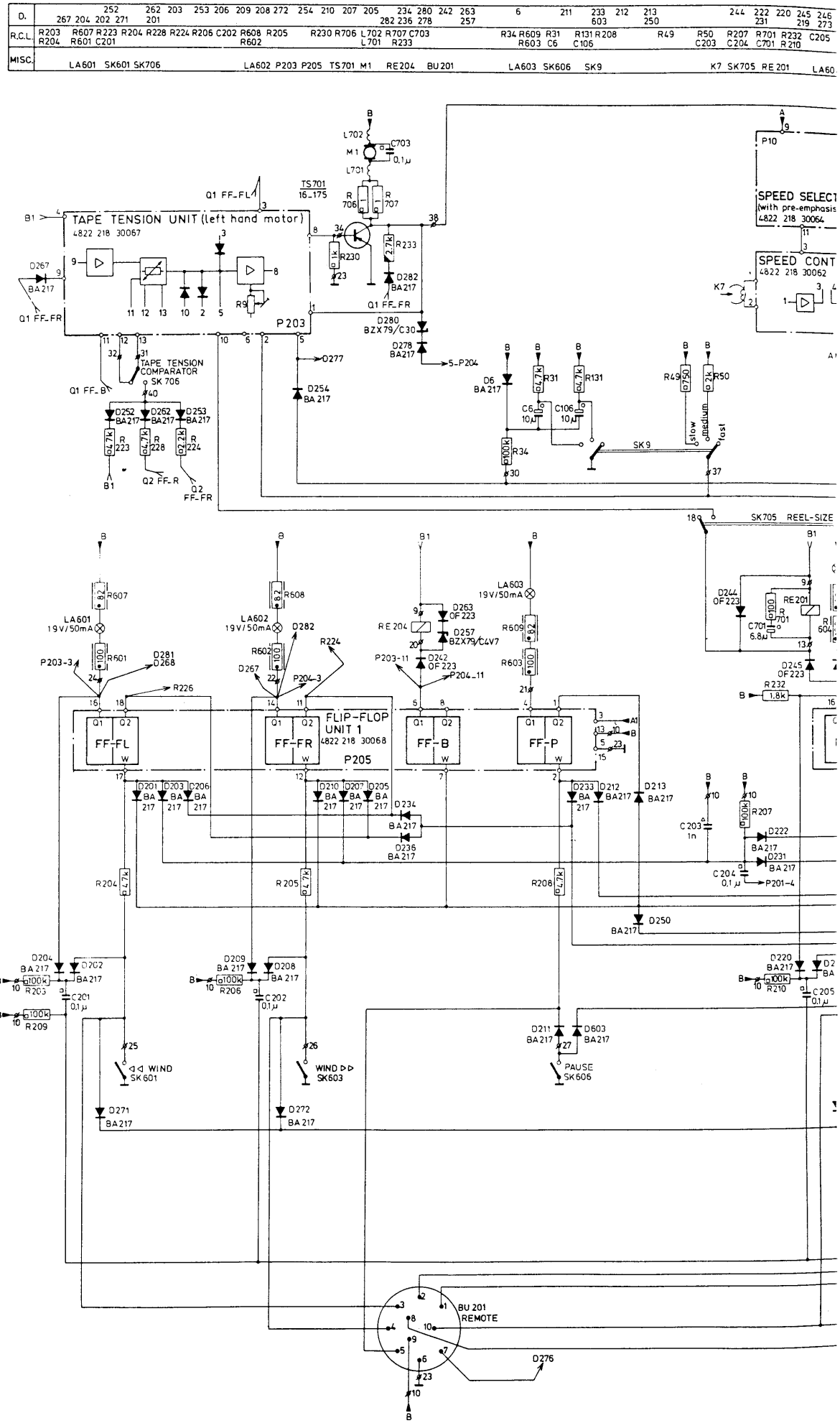
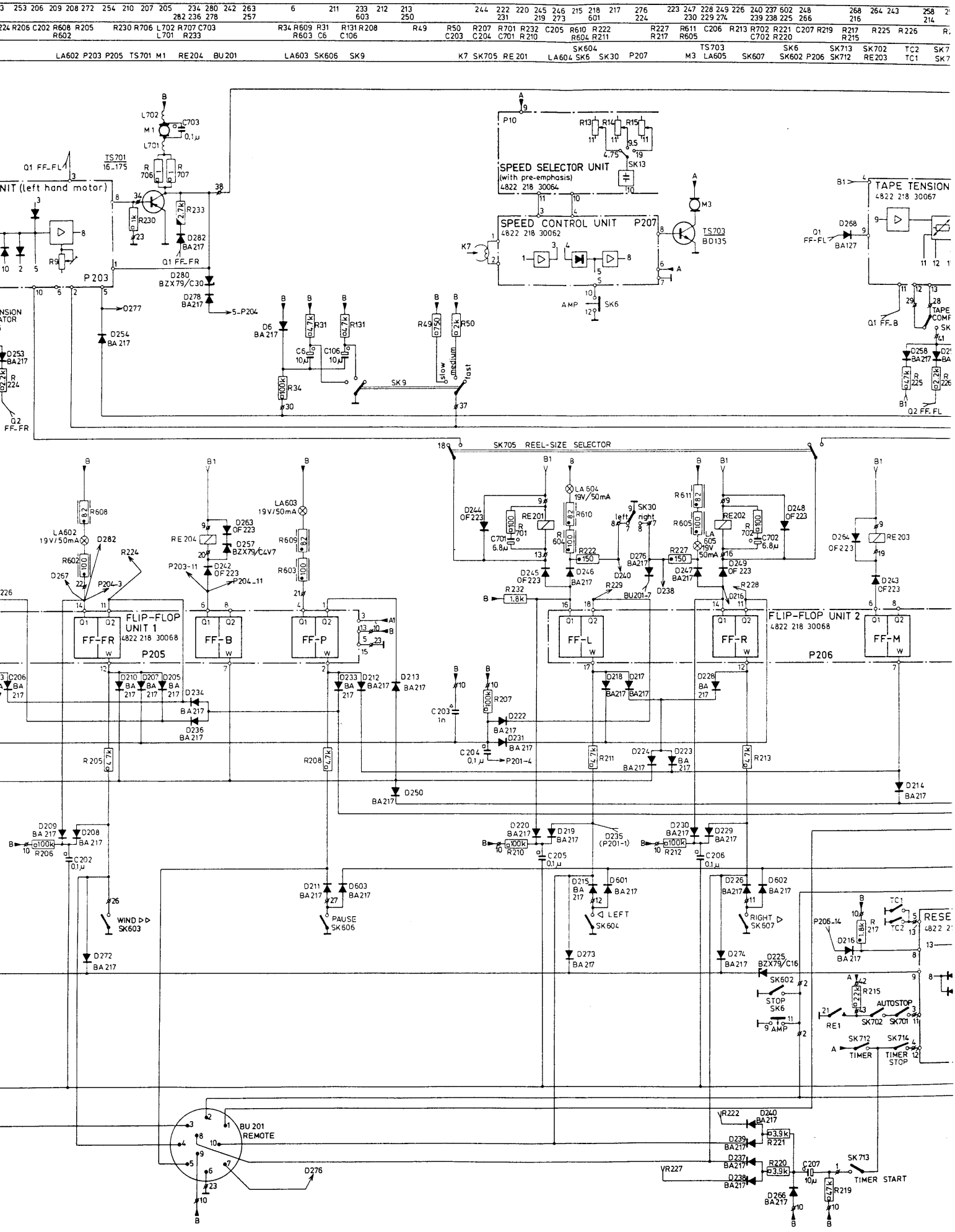
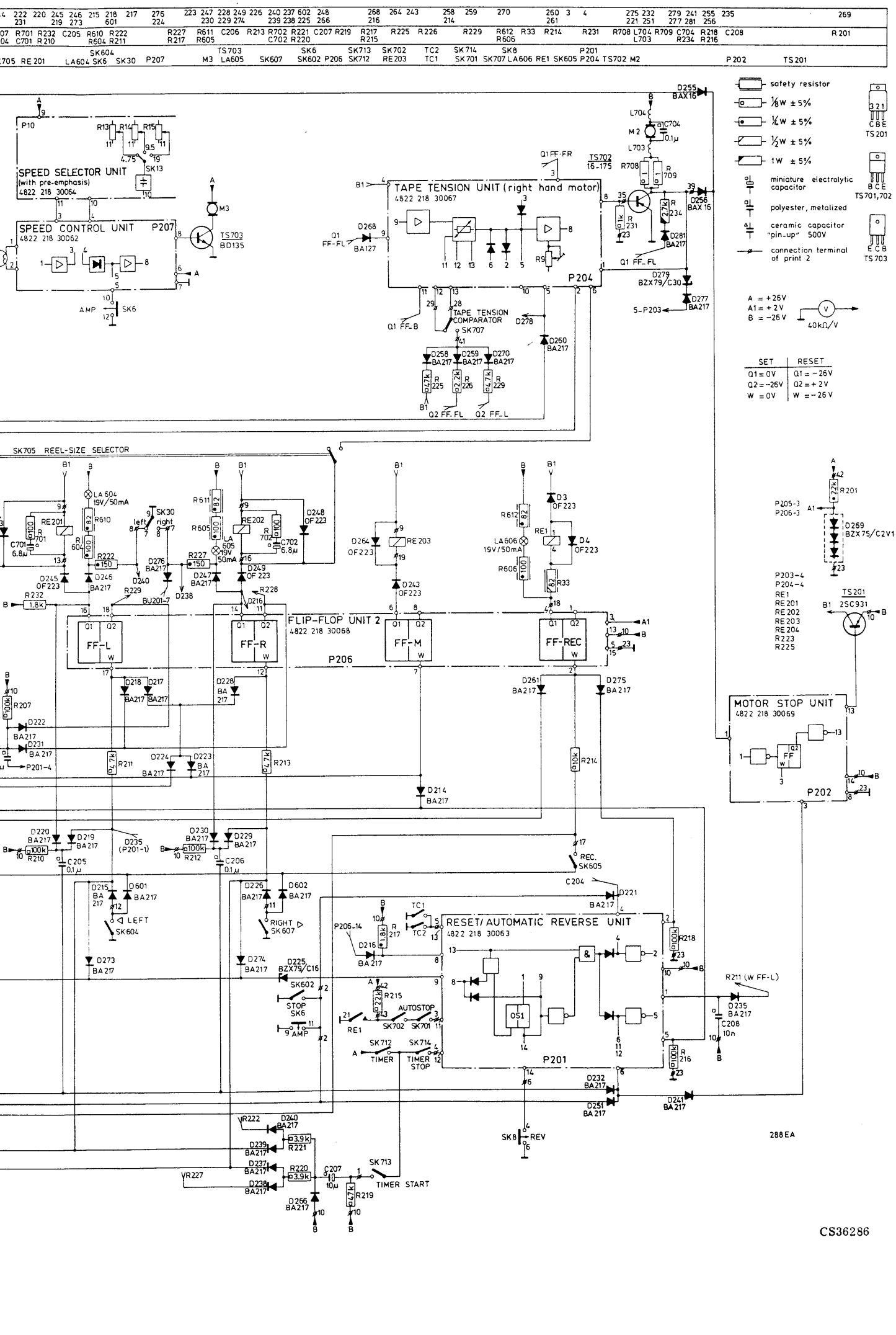
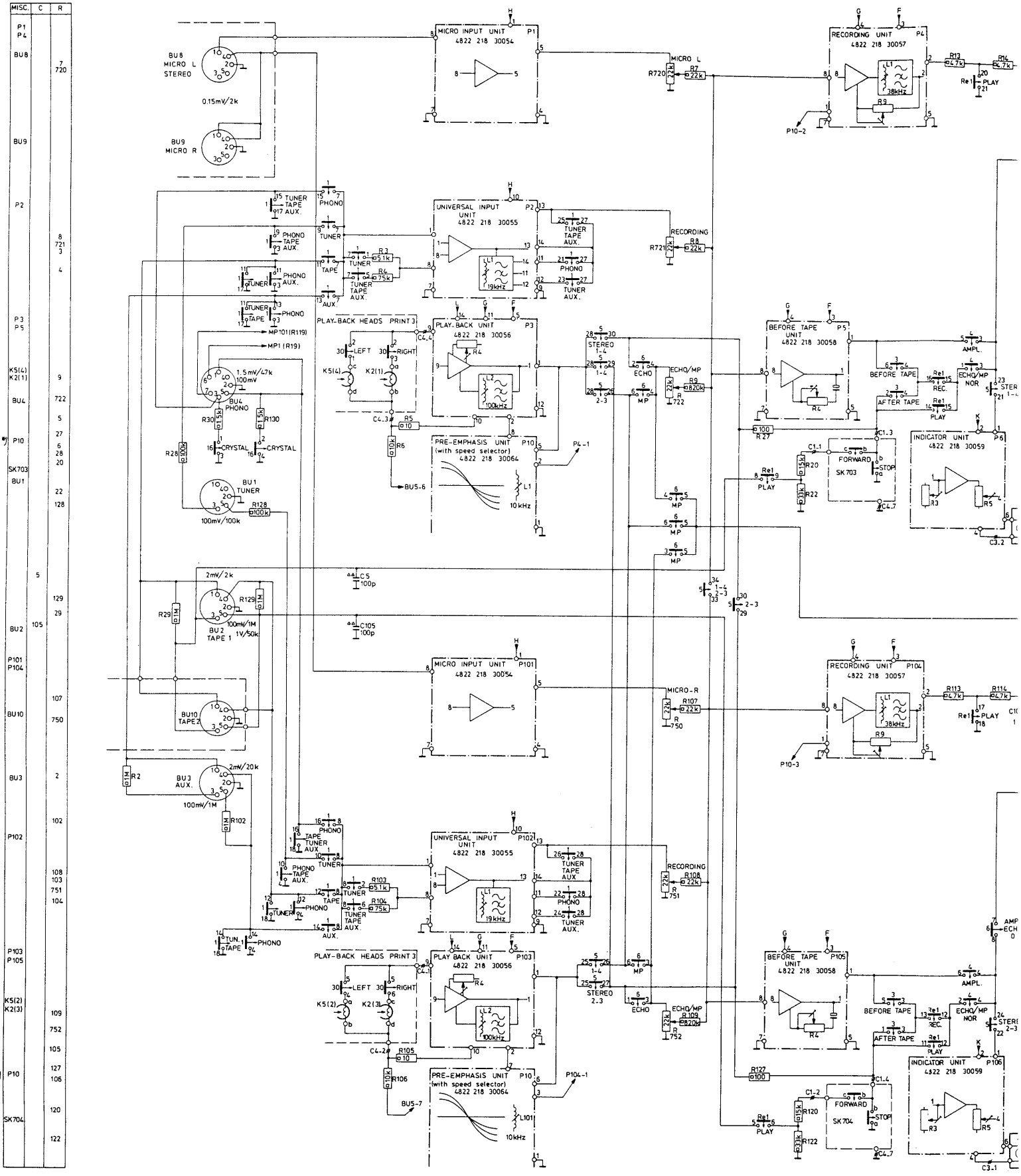

C B E
2SC931
B C E
D330D8D
E C B
BD437
4174A

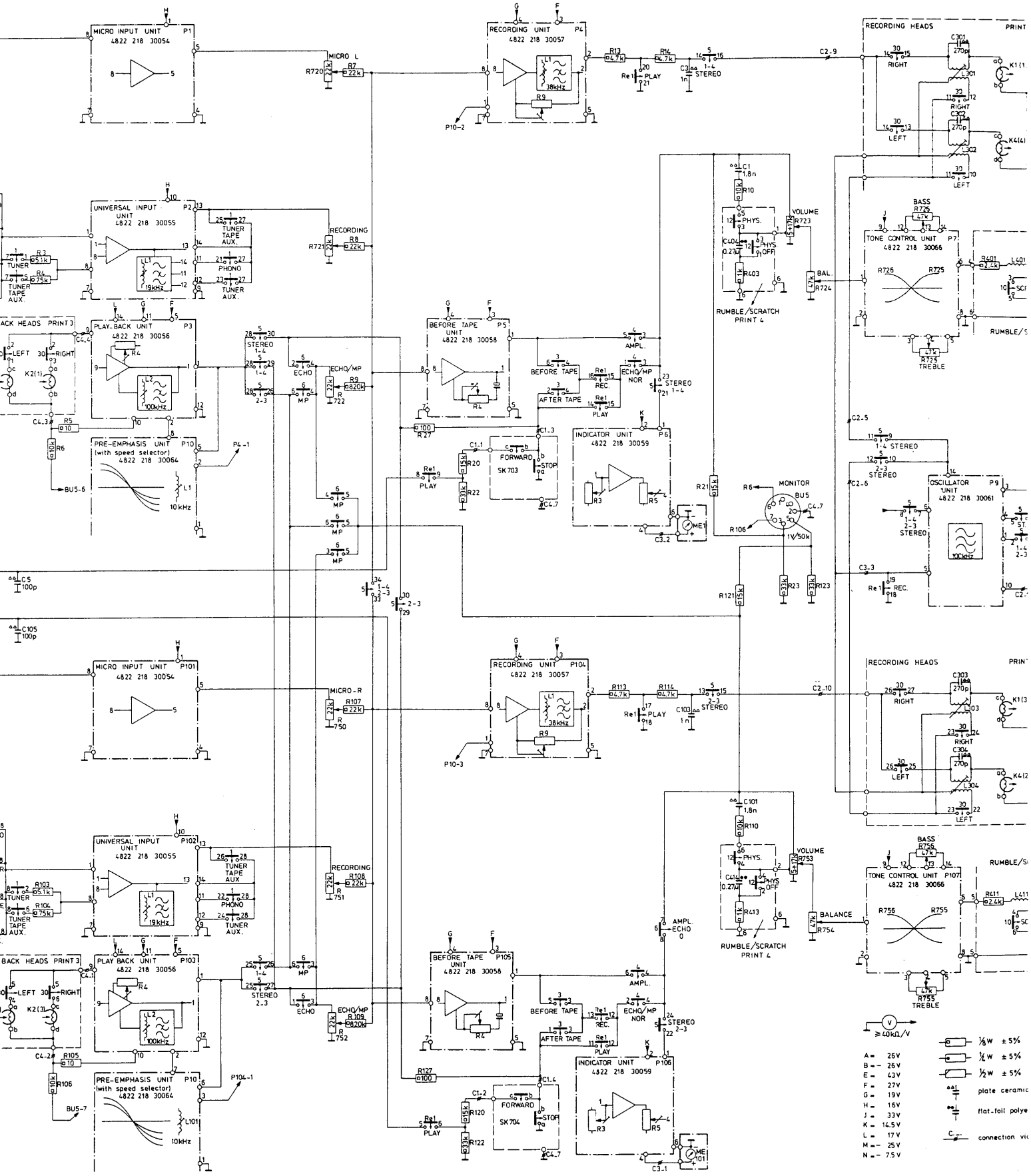
Fig. 4

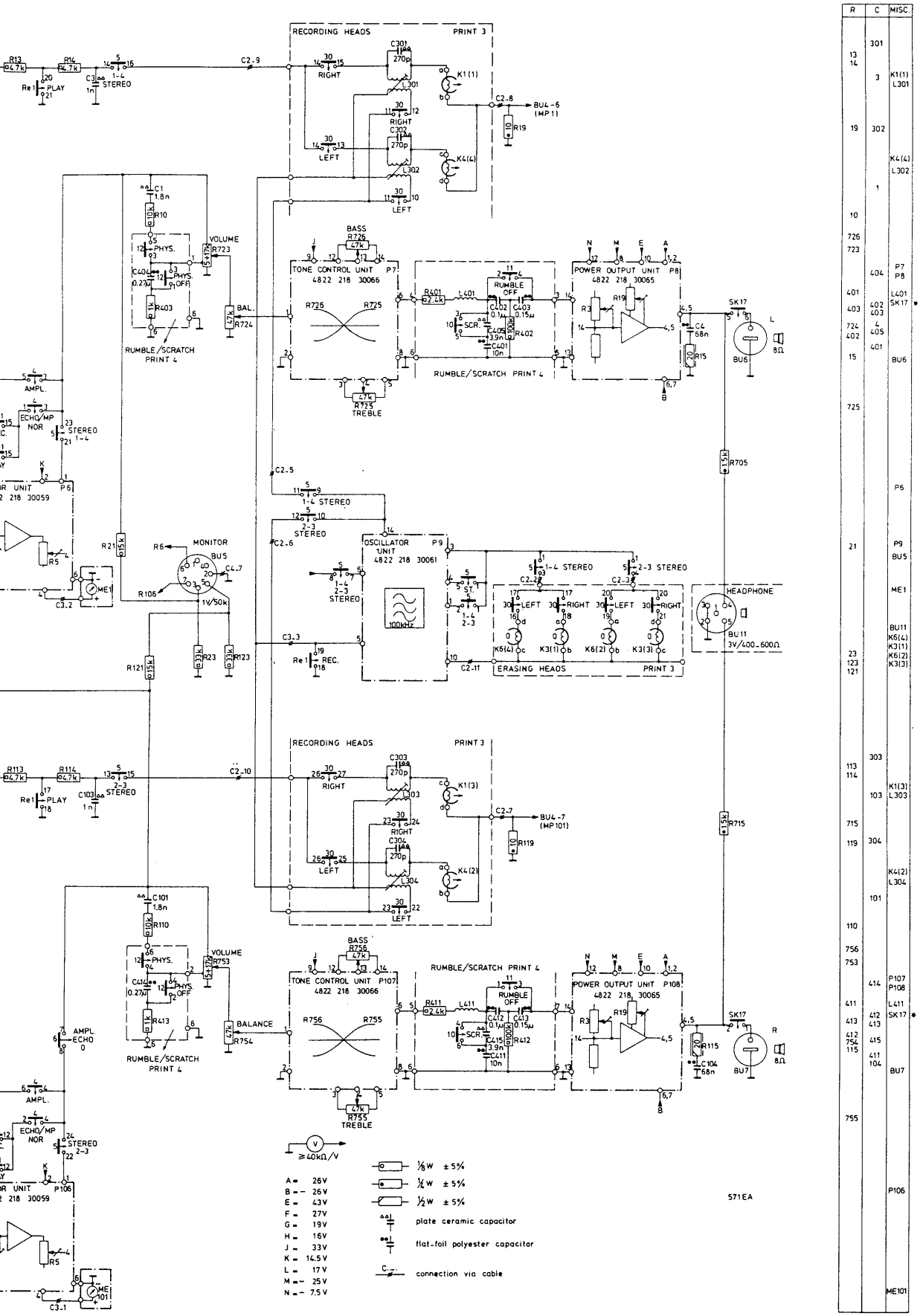

D. 252 262 203 253 206 209 208 272 254 210 207 205 234 280 242 263 6 211 233 212 213 244 222 220 245 246
267 204 202 271 201 282 236 278 257 603 250 231 219 273
R.C.L. R203 R607 R223 R204 R228 R224 R206 C202 R608 R205 R230 R706 L702 R707 C703 R34 R609 R31 R131 R208 R49 R50 R207 R701 R232 C205
R204 R601 C201 R602 L701 R233 R603 C6 C106 C203 C204 C701 R210
MISC. LA601 SK601 SK706 LA602 P203 P205 TS701 M1 RE204 BU201 LA603 SK606 SK9 K7 SK705 RE201 LA60
TAPE TENSION UNIT (left hand motor)
4822 218 30067
TAPE TENSION COMPARATOR SK 706
FLIP-FLOP UNIT 1
4822 218 30068
FF-FL
FF-FR
FF-B
FF-P
SPEED SELECT
(with pre-emphasis
4822 218 30064
SPEED CONT
4822 218 30062
SK705 REEL-SIZE
WIND ◁◁ SK601
WIND ▷▷ SK603
PAUSE SK606
BU 201 REMOTE
LA601 19V/50mA
LA602 19V/50mA
LA603 19V/50mA
RE 204
RE201
TS701 16_175
L702
M1
L701
C703
0,1µ
R 706
R 707
R233
R230
D282 BA217
D280 BZX79/C30
D278 BA217
D254 BA 217
D277
5-P204
D6 BA217
R31
R131
C6 10µ
C106 10µ
R34
R49 750
R50
slow
medium
fast
D252 BA217
D262 BA217
D253 BA217
R223
R228
R224
Q1 FF_FL
Q1 FF_FR
Q1 FF_B
Q2 FF_R
Q2 FF-FR
D267
D281 D268
R226
R607
R608
R601
R602
R224
P203-3
P204_3
P203-11
P204_11
D263 OF 223
D257 BZX79/C4V7
D242 OF 223
R609
R603
D244 OF 223
D245 OF 223
R232 1.8k
C701 6.8µ
R701
D201 D203 D206
D210 D207 D205
D234
D236
D233 D212 D213
R207
C203 1n
D222
D231
C204 0,1µ
P201-4
R204
R205
R208
D250
D204 D202
D209 D208
D220
R203
R206
R210
C201 0,1µ
C202 0,1µ
C205 0,1µ
R209
D211 D603
D271
D272
D276
P10
K7
SK9
P203
P205


SPEED SELECTOR UNIT
(with pre-emphasis)
4822 218 30064
SPEED CONTROL UNIT P207
4822 218 30062
TAPE TENSION
4822 218 30067
SK705 REEL-SIZE SELECTOR
FLIP-FLOP UNIT 1
4822 218 30068
P205
FF-FR
FF-B
FF-P
FLIP-FLOP UNIT 2
4822 218 30068
P206
FF-L
FF-R
FF-M
BU 201
REMOTE
WIND
PAUSE
LEFT
RIGHT
STOP
AUTOSTOP
TIMER
TIMER STOP
TIMER START
SPEED
TAPE COMP

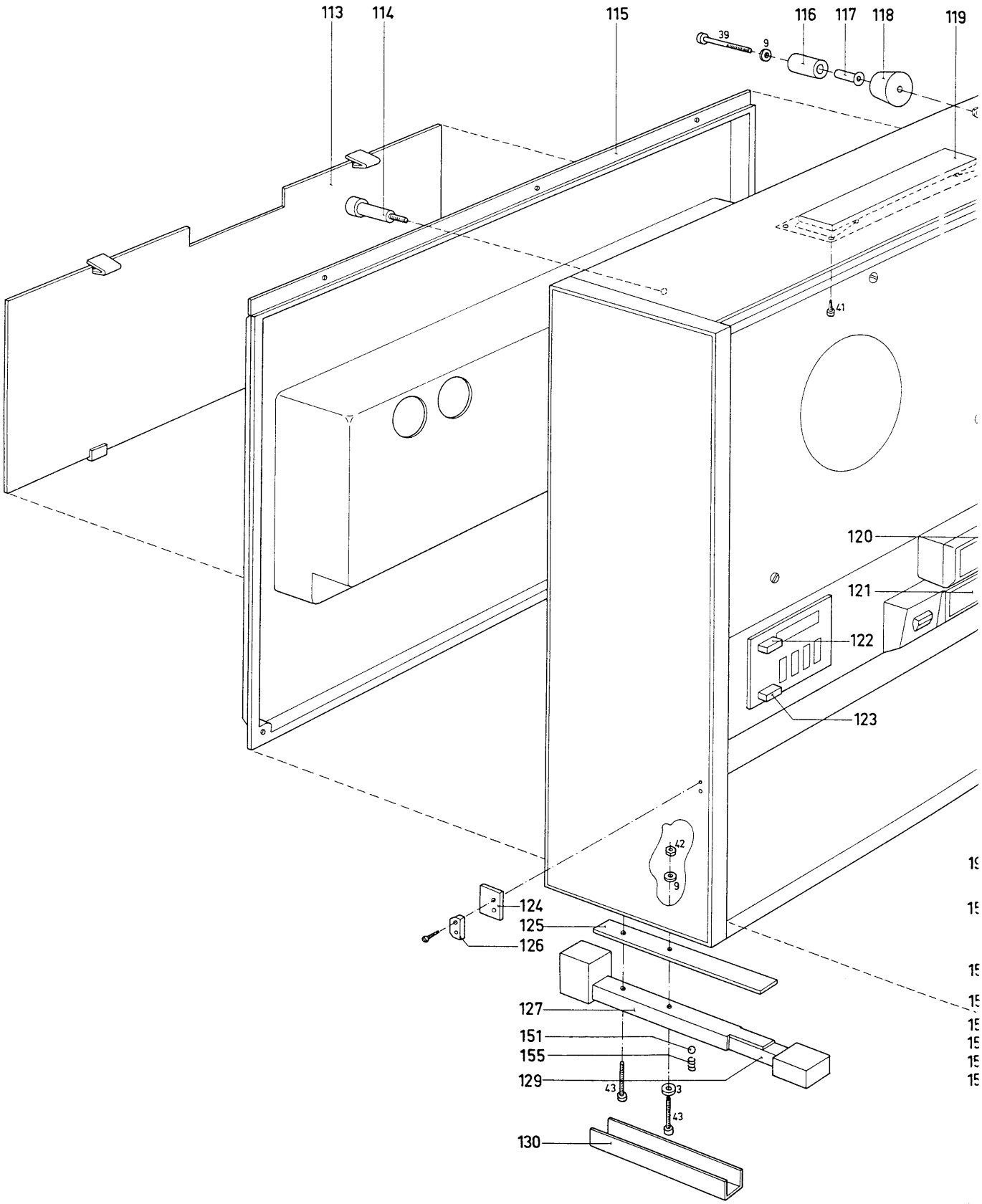

SPEED SELECTOR UNIT
(with pre-emphasis)
4822 218 30064
SPEED CONTROL UNIT P207
4822 218 30062
TAPE TENSION UNIT (right hand motor)
4822 218 30067
TAPE TENSION COMPARATOR
SK707
P204
SK705 REEL-SIZE SELECTOR
FLIP-FLOP UNIT 2
4822 218 30068
FF-L
FF-R
FF-M
FF-REC
P206
MOTOR STOP UNIT
4822 218 30069
P202
RESET/ AUTOMATIC REVERSE UNIT
4822 218 30063
P201
TIMER START
safety resistor
1/8W ± 5%
1/4W ± 5%
1/2W ± 5%
1W ± 5%
miniature electrolytic capacitor
polyester, metalized
ceramic capacitor "pin-up" 500V
connection terminal of print 2
A = +26V
A1 = +2V
B = −26V
40kΩ/V
SET
RESET
Q1 = 0V
Q1 = −26V
Q2 = −26V
Q2 = +2V
W = 0V
W = −26V
TS201
TS701,702
TS703
288EA
CS36286


MISC. C R
P1 P4
BU8
BU9
P2
P3 P5
K5(4) K2(1)
BU4
P10
SK703
BU1
5
BU2
105
P101 P104
BU10
BU3
P102
P103 P105
K5(2) K2(3)
SK704
BU8 MICRO L STEREO
0.15mV/2k
BU9 MICRO R
MICRO INPUT UNIT P1 4822 218 30054
MICRO L
R720 2k2
R7 22k
RECORDING UNIT P4 4822 218 30057
38kHz
R9
R13 4.7k
R14 4.7k
Re1
PLAY
P21
P10-2
UNIVERSAL INPUT UNIT 4822 218 30055
TUNER TAPE AUX.
PHONO
TUNER
TAPE
R3 51k
R4 75k
19kHz
RECORDING
R8 22k
PLAY-BACK HEADS PRINT 3
PLAY-BACK UNIT 4822 218 30056
LEFT
RIGHT
100kHz
STEREO 1-4 2-3
ECHO
ECHO/MP
R9 820k
MP
BEFORE TAPE UNIT 4822 218 30058
AMPL.
BEFORE TAPE
AFTER TAPE
REC.
PLAY
ECHO/MP NOR
R27 100
INDICATOR UNIT 4822 218 30059
FORWARD
STOP
SK703
R20 15k
R22 33k
C1.1
C1.3
C4.7
C3.2
MP101(R119)
1.5mV/47k 100mV
R30 1.5k
R130 1.5k
R28 100k
CRYSTAL
R128 100k
100mV/100k
R5 10
R6 10k
C4.3
PRE-EMPHASIS UNIT (with speed selector) 4822 218 30064
10kHz
BU5-6
P4-1
LCS 100p
C105 100p
2mV/2k
R129 1M
R29 1M
100mV/1M 1V/50k
BU2 TAPE 1
MICRO INPUT UNIT P101 4822 218 30054
MICRO-R
R107 22k
R 750
RECORDING UNIT P104 4822 218 30057
R113 4.7k
R114 4.7k
P10-3
BU10 TAPE 2
2mV/20k
BU3 AUX.
100mV/1M
R2 1M
R102 1M
UNIVERSAL INPUT UNIT 4822 218 30055
R103 51k
R104 75k
R108 22k
R 751
PLAY-BACK HEADS PRINT 3
PLAY BACK UNIT 4822 218 30056
K5(2)
K2(3)
C4.2
R105 10
R106 10k
PRE-EMPHASIS UNIT (with speed selector) 4822 218 30064
L101
10kHz
BU5-7
P104-1
R109 820k
R 752
R120 15k
R122 33k
R127 100
C1.2
C1.4
C4.7
C3.1
CS36287


MICRO INPUT UNIT P1
4822 218 30054
RECORDING UNIT P4
4822 218 30057
RECORDING HEADS
UNIVERSAL INPUT UNIT
4822 218 30055
PLAY-BACK UNIT P3
4822 218 30056
BEFORE TAPE UNIT
4822 218 30058
INDICATOR UNIT
4822 218 30059
PRE-EMPHASIS UNIT P10
(with speed selector)
4822 218 30064
TONE CONTROL UNIT P7
4822 218 30066
OSCILLATOR UNIT P9
4822 218 30061
MICRO INPUT UNIT P101
4822 218 30054
RECORDING UNIT P104
4822 218 30057
UNIVERSAL INPUT UNIT P102
4822 218 30055
PLAY BACK UNIT P103
4822 218 30056
BEFORE TAPE UNIT P105
4822 218 30058
INDICATOR UNIT P106
4822 218 30059
TONE CONTROL UNIT P107
4822 218 30066
RUMBLE/SCRATCH PRINT 4
MONITOR BUS
RECORDING
TUNER
TAPE AUX.
PHONO
STEREO
MONO
RIGHT
LEFT
PLAY
REC.
FORWARD
STOP
VOLUME
BASS
TREBLE
BALANCE
ECHO/MP
ECHO
AMPL.
PHYS.
OFF
1V/50k
10kHz
100kHz
19kHz
38kHz




| R | C | MISC. |
|---|---|---|
| | 301 | |
| 13 | | |
| 14 | | |
| | 3 | K1(1) |
| | | L301 |
| 19 | 302 | |
| | | K4(4) |
| | | L302 |
| | 1 | |
| 10 | | |
| 726 | | |
| 723 | | |
| | 404 | P7 |
| | | P8 |
| 401 | | L401 |
| 403 | 402 | SK17 * |
| | 403 | |
| 724 | 4 | |
| 402 | 405 | |
| | 401 | |
| 15 | | BU6 |
| 725 | | |
| | | P6 |
| | | P9 |
| 21 | | BU5 |
| | | ME1 |
| | | BU11 |
| | | K6(4) |
| | | K3(1) |
| 23 | | K6(2) |
| 123 | | K3(3) |
| 121 | | |
| | 303 | |
| 113 | | |
| 114 | | K1(3) |
| | 103 | L303 |
| 715 | | |
| 119 | 304 | |
| | | K4(2) |
| | | L304 |
| | 101 | |
| 110 | | |
| 756 | | |
| 753 | | |
| | 414 | P107 |
| | | P108 |
| 411 | | L411 |
| 413 | 412 | SK17 * |
| | 413 | |
| 412 | | |
| 754 | 415 | |
| 115 | | |
| | 411 | |
| | 104 | BU7 |
| 755 | | |
| | | P106 |
| | | ME101 |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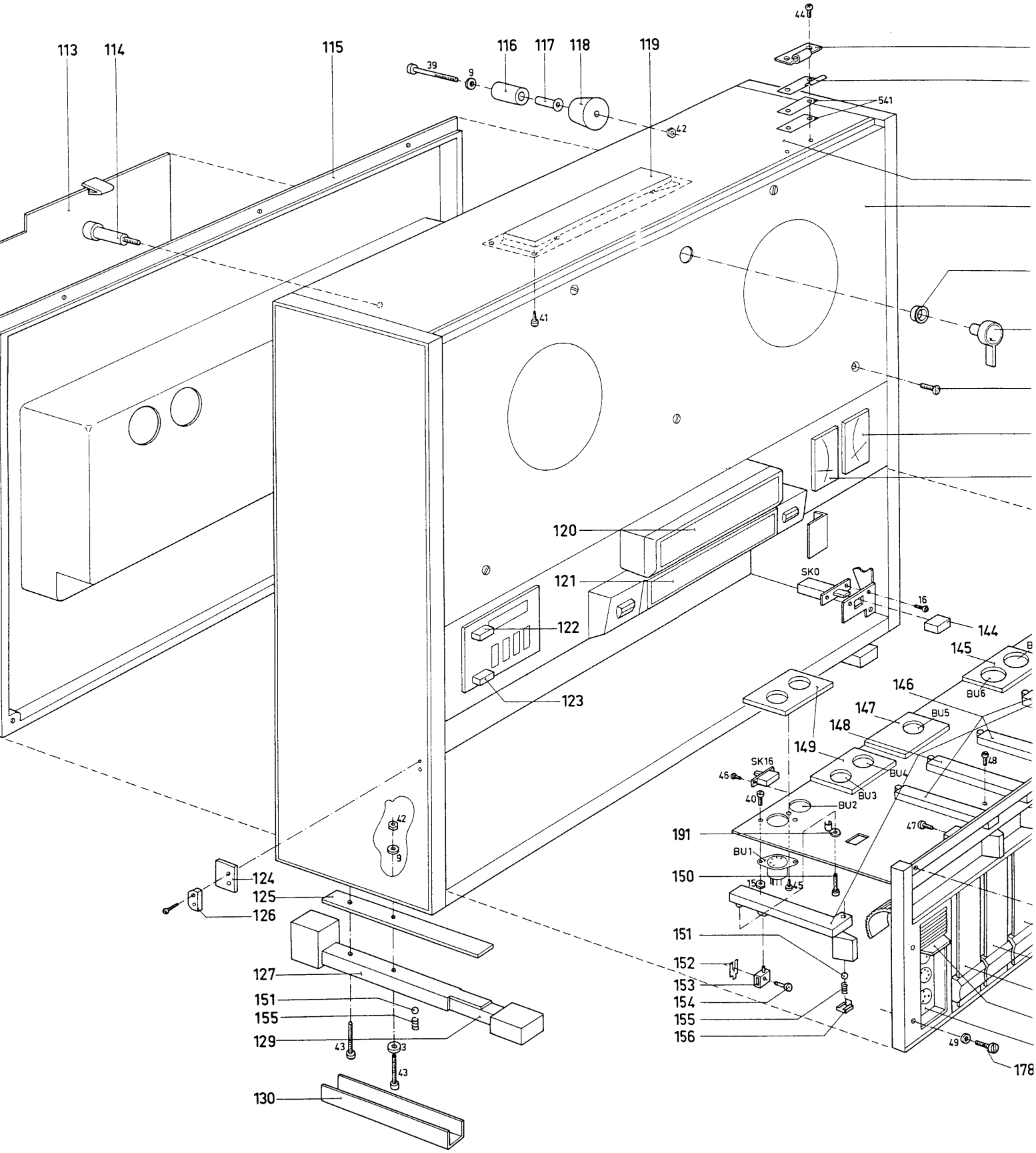
127
151
155
129
43
3
43
130


113
114
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118
119
39
9
42
44
541
41
120
121
122
123
SK0
16
144
145
146
147
148
149
BU6
BU5
BU4
BU3
BU2
BU1
SK16
46
40
48
47
191
150
15
45
151
152
153
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156
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178
124
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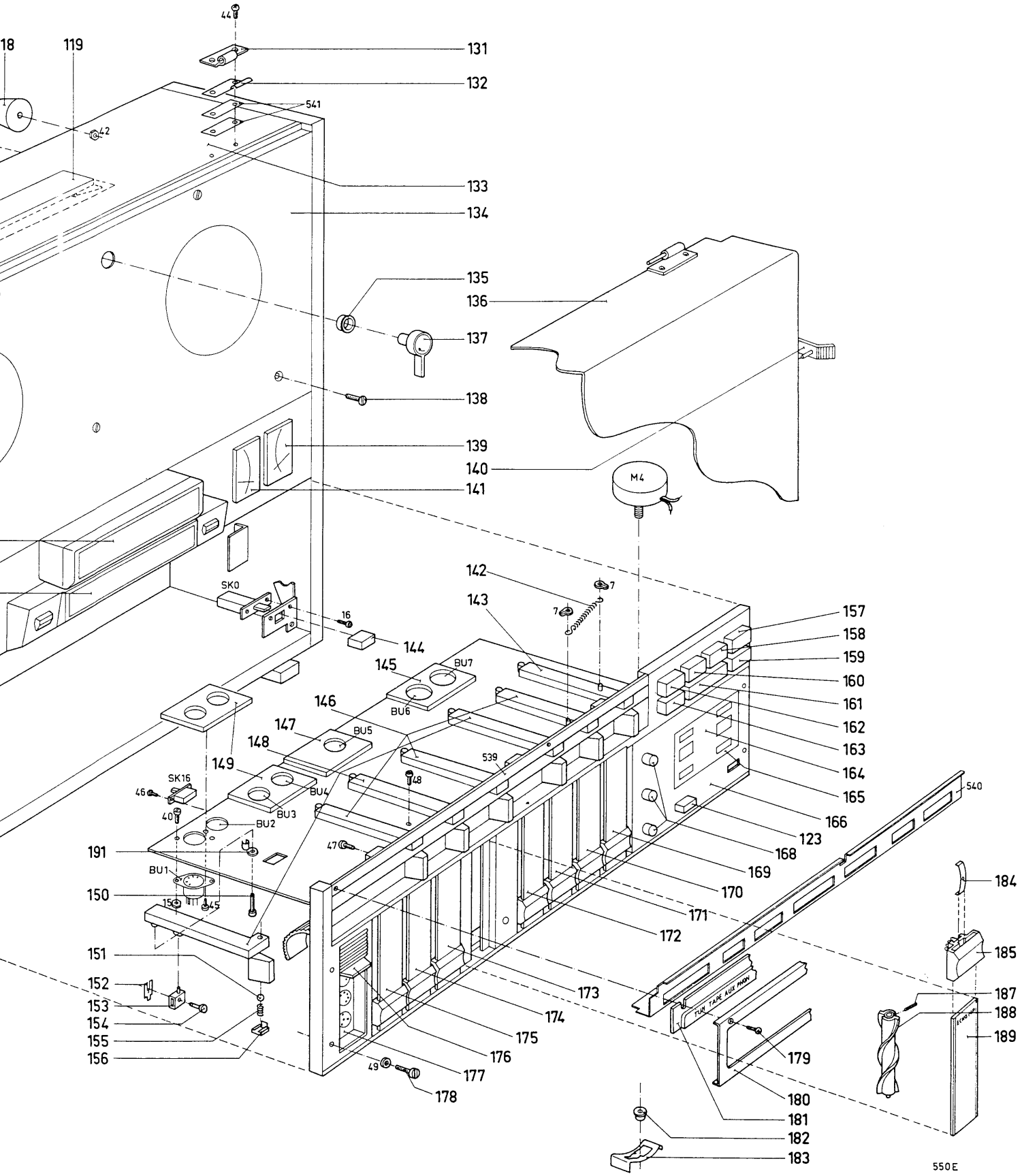
126
127
151
155
129
43
3
130


44
18
119
131
132
541
42
133
134
135
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139
140
141
M4
SK0
16
144
142
7
143
157
158
159
160
161
162
163
164
165
166
123
168
169
170
171
172
173
174
175
176
177
178
145
BU7
BU6
146
147
BU5
148
149
BU4
BU3
BU2
BU1
539
48
SK16
46
40
47
191
150
15
45
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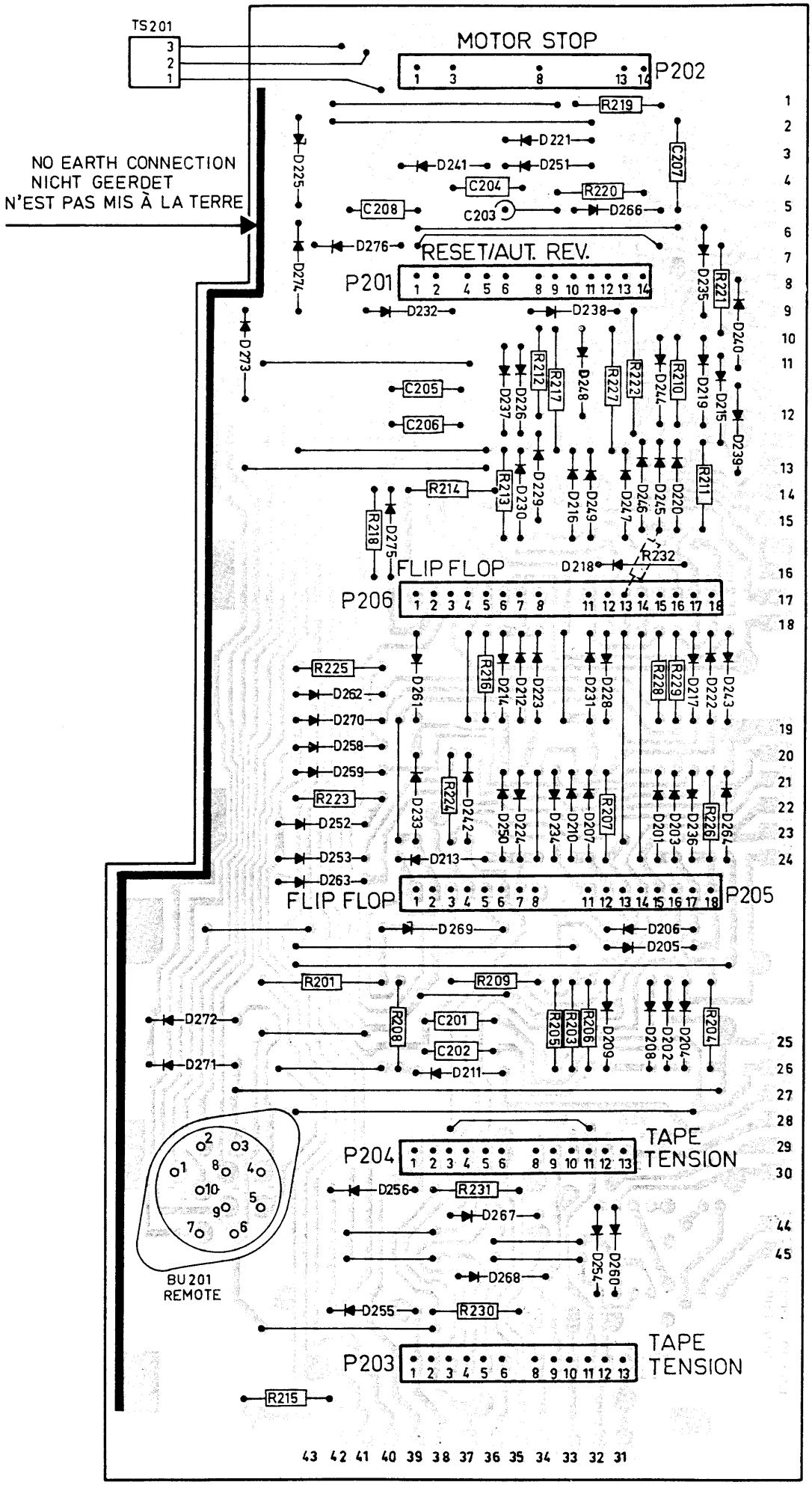
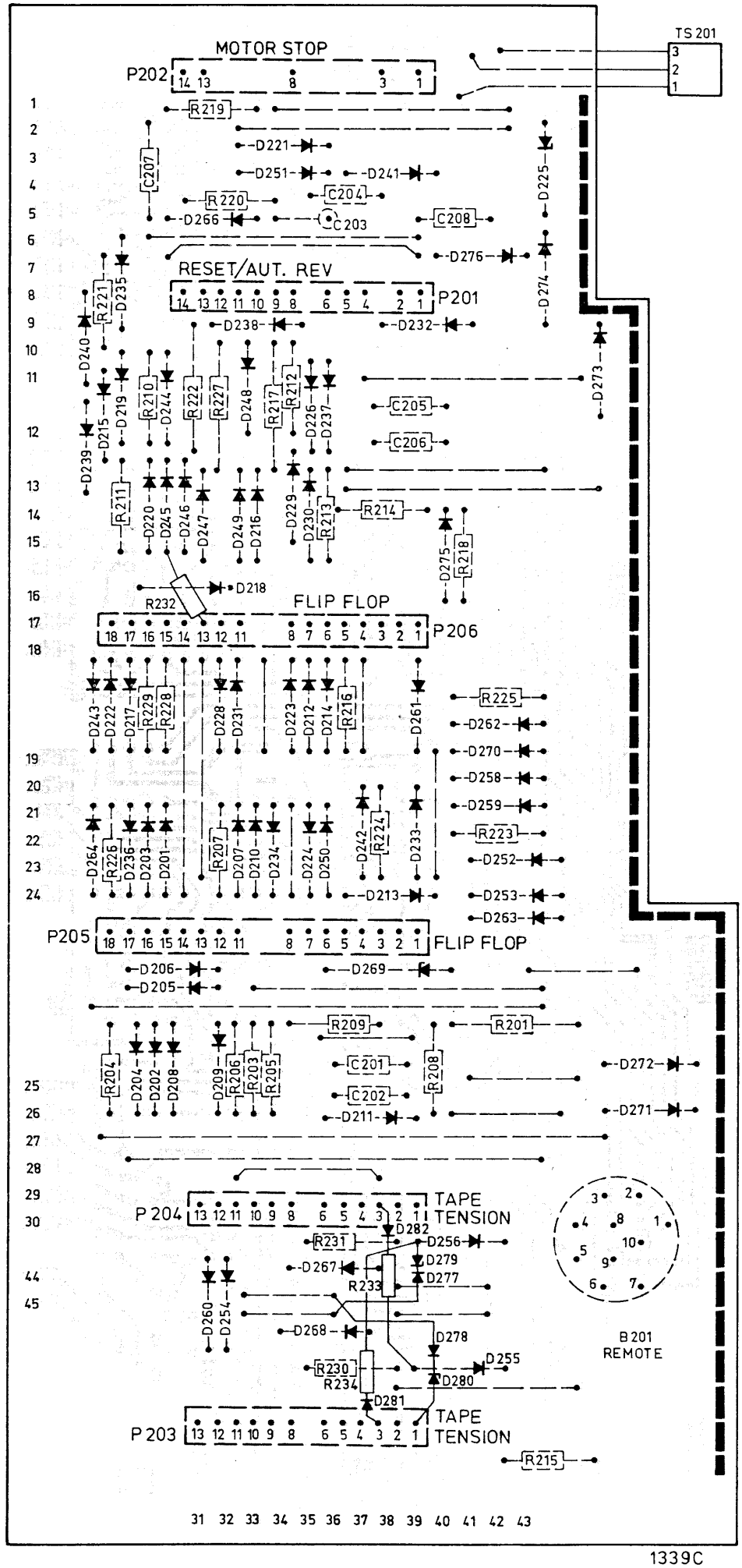
182
183
550E

CS36284




552 C

CS36285


MOTOR STOP
P202
TS 201
RESET/AUT. REV
P201
FLIP FLOP
P206
P205
FLIP FLOP
P204
TAPE TENSION
P203
TAPE TENSION
B201 REMOTE
1339C

# Service Information

28-12-1972

RECORDERS N 4450

Bc 1329

PHILIPS

## I. SEVERAL MODIFICATIONS

### A. Version WR04

. In sets, marked from 144, the pulleys 55 are secured with two Allen screws M3x8 (item 4).
The code number of these screws is 4822 502 11069.
. The glue of the tape on the anchor plate of the electromagnets RE201...RE204 had not hardened enough. Consequently, the anchor was sticking in some cases.
In sets WR04/05, from serial number 3100, the glue has better hardened.

### B. Version WR05

. In sets, marked from 147, safety resistors R43...R46 of 180 Ω have been added in series with lamps LA1...LA4. This has been done to extend the lifes of these lamps. Besides, the values of R47 and R48 have been changed from 22 Ω into 120 Ω.
For code numbers, see the List of Electrical Parts, B Supply.

### C. Version WR06

. In sets, marked from 147, a 80-mA fuse has been added in series with timer motor M4. In sets WR08, marked from 206, the value of this fuse has been changed into 250 mA-T.
. In sets, marked from 148 - serial number 3350, diode D227 (connected to W/FF-R) has been left out.
In position "REV", the pulse from the tape contact is applied, via the reset/automatic reverse unit P201, to flip-flop FF-L. Owing to tolerances of the components used in the flip-flops, it may happen that FF-L is preferred to FF-R. Under these circumstances, FF-R cannot be switched on any more. Now that D227 is no longer used, FF-R is preferred to FF-L.

### D. Version WR07

. In sets, marked from 149 - serial number 4600, the transistors TS701, 702 (controlling the winding motors) have been replaced by type 16-175 (=2N6107).
The code number of TS701, 702 is 4822 130 40903.
. In sets, marked from 150, a recess has been made to the right of bracket 540. Via this recess, bracket 550 is adjustable. This was necessary because, in a few cases, switch SK9 (FAST-MED-SLOW) did not operate.

### E. Version WR08

. In sets, marked from 203, the screws securing the capstan motor M3 (11 in bracket 536) have been lockpainted.
. In sets, marked from 203, ornamental frame 180 has been secured with 10 instead of with 6 screws.
The code number of ornamental frame 180 with 10 screw holes remains unchanged: 4822 460 20067.
. In sets, marked from 203, a ring has been added between flywheels 95 and capstan bearings 88. This has been done because the sets produced a scouring noise when being tilted forwards.
The code number of ring 200 is: 4822 532 50301.
. In sets, marked from 203, the lower part of ornamental cover 136 can be fixed when it is opened.
The code number of ornamental cover 136 with closing bracket 140 remains unchanged: 4822 443 20071.
The code number of bracket 140 is: 4822 403 50738.
. In sets, marked from 206, the value of fuse Z701 (in series with timer motor M4) has been changed from 80 mA into 250 mA-T.
The code number of the fuse is: 4822 253 30013.

### F. Version WR09

. In sets, marked from 210, the screws 96 (for adjusting the heads) have finer threads so that it is possible to adjust the heads more precisely.
The code number of screw 96 is: 4822 502 10665.
. In sets, marked from 227, silicone paste has been applied between the mounting plate and transistors TS701, TS702 with a view to a better thermal conduction.
. In sets, marked from 238, serial number 6001, an additional bracket 542 has been fitted to prevent the oil seals 87 from shifting.

## II. MULTIWAY CONNECTORS

The functional units are secured to p.c. boards 1 and 2 with multiway connectors for three, eight or fourteen contacts. Whether or not these contacts are available, depends upon the circuit on the units; consequently, there is a great number of versions. For servicing purposes, only three versions are supplied, namely: the 3-pole, the 8-pole and the 14-pole versions with all contacts. Non-functional contacts can be easily removed with tweezers.

## III. MODIFICATIONS AND ADDITIONS TO LIST OF MECHANICAL PARTS.

### A. Tape deck

| | | |
|---|---|---|
| 2 | Screw M3x4 | 4822 502 11069 |
| 4 | Screw M3x8 | 4822 502 10174 |
| 5 | Nut M5 | 4822 505 10513 |
| 8 | Ring 3,2 x 7 x 0,3 | 4822 532 50298 |
| 9 | Ring 4,2 x 8 x 0,5 | 4822 532 10333 |
| 14 | Ring 3,2 x 6 x 0,4 | 4822 530 80082 |
| 17 | Ring 3,2 x 9 x 0,8 | 4822 532 10582 |
| 20 | Ring | 4822 532 20619 |
| 24 | Clamping ring 4 dia | 4822 530 70116 |
| 25 | Ring 3,2 x 7 x 0,5 | 4822 532 10332 |
| 26 | Screw M3x4 | 4822 502 11189 |
| 27 | Ring | 4822 532 10332 |
| 29 | Ring 3,2 x 4,5 x 0,3 | 4822 532 50938 |
| 32 | Screw M3x20 | 4822 502 11096 |
| 33 | Spacer 3,1 x 16 x 5 | 4822 532 20607 |
| 35 | Screw M2x8 | 4822 502 10681 |
| 47 | Screw M4x8 | 4822 502 10693 |
| 49 | Ring 4,2 x 8 x 0,1 | 4822 532 10479 |
| 50 | Ring 3,2 x 8 x 0,2 | 4822 532 50298 |
| 57 | Cord | 4822 358 30145 |
| 60 | Bearing | 4822 502 10765 |
| 71 | Ring | 4822 532 30266 |
| 79 | Cord | 5322 358 30045 |
| 96 | Screw | 4822 502 10665 |
| 97 | Screw M3 | 4822 502 11217 |
| 98 | Nut M3 | 4822 505 10408 |
| 104 | Pressure spring | 4822 492 50925 |
| 105 | Bearing | 4822 535 70468 |
| 110 | Grommet | 4822 528 80545 |
| 200 | Ring 5,2 x 9 x 0,5 | 4822 532 50301 |
| 201 | Screw M3x8 | 4822 502 11053 |
| 202 | Ring 3,6 x 12 x 1 | 4822 532 10489 |
| 203 | Ring | 4822 532 50786 |
| 204 | Tension spring | 4822 492 30355 |
| 205 | Cord damper | 4822 479 30045 |

SERVICE

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B. Cabinet and amplifier

| | | |
|---|---|---|
| 3 | Ring | 4822 532 50725 |
| 15 | Nut M3 | 4822 505 10325 |
| 39 | Screw M4x30 | 4822 502 10053 |
| 40 | Screw M3 | 4822 502 11287 |
| 41 | Screw 3.9 x 9.13 | 4822 502 30006 |
| 43 | Screw M4x22 | 4822 502 10051 |
| 44 | Self-tapping screw 2.9 x 15 | 4822 502 30048 |
| 45 | Self-tapping screw 2.9 x 4.37 | 4822 502 30065 |
| 118 | Support | 4822 325 20063 |
| 131 | Hinge | 4822 417 10516 |
| 139 | Meter on the right (ME101) | 4822 347 10069 |
| 140 | Bracket | 4822 403 50738 |
| 141 | Meter on the left (ME1) | 4822 347 10071 |
| 149 | Socket-cover plate | 4822 459 80039 |
| 151 | Ball 5/32" | 5322 520 40012 |
| 154 | Pin | 4822 535 90912 |
| | Ball for SK5 | 4822 535 90913 |
| 155 | Pressure spring | 4822 492 50927 |
| | Pressure spring (light conductor for switch FAST-MED-SLOW) | 4822 492 51037 |
| 187 | Screw M3x4 | 4822 502 10663 |
| 190 | Lense | 4822 381 10401 |
| 191 | Lamp holder | 4822 256 90135 |

## IV. MODIFICATIONS AND ADDITIONS TO LIST OF ELECTRICAL PARTS

A. Control section

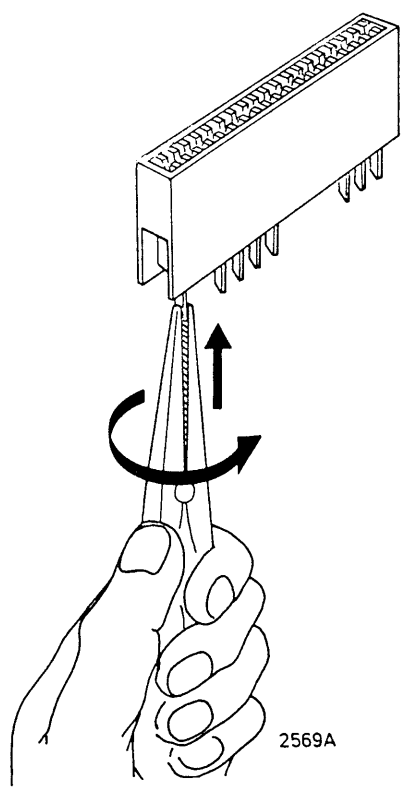
| | | |
|---|---|---|
| SK8 | Slide switch (NOR-REV) | 4822 277 30378 |
| SK702 | Switch (counter) | 4822 278 90231 |
| | Plug for BU201 | 5322 264 50043 |
| TS201 | Transistor 2 SC931 | 4822 130 40899 |
| TS701, 702 | Transistor 16-175 (=N1607) | 4822 130 40903 |
| | Lampholder for LA601...LA606 | 4822 401 10561 |

B. Supply

| | | |
|---|---|---|
| SK105 | Voltage adapter | 4822 272 10202 |
| LA8, 9 | Lamp 19 V-50 mA (timer) | 4822 134 40078 |
| | Lampholder for LA1...LA4 | 4822 256 90135 |
| | Lampholder for LA701, 702 | 4822 401 10561 |
| | Fuse holder for Z501, 502 | 4822 492 60063 |
| Z701 | Fuse 250 mA-T | 4822 253 30013 |
| | Fuse holder for Z701 | 4822 256 30128 |
| R35 | Safety resistor 10 kΩ | 4822 110 53134 |
| R36, 132 | Safety resistor 68 Ω | 4822 110 53076 |
| R37 | Safety resistor 330 Ω | 4822 110 43094 |
| R38 | Safety resistor 820 Ω | 4822 111 30424 |
| R39 | Safety resistor 560 Ω | 4822 111 30374 |
| R40 | Safety resistor 1 kΩ | 4822 111 30404 |
| R41 | Safety resistor 3k3 | 4822 111 30413 |
| R42 | Safety resistor 3 kΩ | 4822 111 30442 |
| R47, 48 | Safety resistor 120 Ω | 4822 111 50135 |
| R133, 134, 43 44, 45, 46 | Safety resistor 180 Ω | 4822 110 43087 |
| R502 | Safety resistor 33 Ω | 4822 111 30418 |

C. Amplifier

| | | |
|---|---|---|
| SK703, 704 | | 4822 278 90232 |
| | Contact spring for BU8...BU10 (signal) | 4822 268 20032 |
| | Contact spring for BU8...BU10 (earth) | 4822 492 61313 |
| | Plug for BU1...BU5 and BU8...BU10 | 4822 264 40023 |
| | Plug for BU6, 7 | 4822 264 30041 |
| | Plug for BU11 | 4822 264 40092 |
| | Adjusting core for L301...L304 | 4822 526 10014 |
| ME1 | Meter, left | 4822 347 10071 |
| ME101 | Meter, right | 4822 347 10069 |
| | Plug on cable tree, 14 poles | 4822 264 50079 |
| C13 | 150 µF-25 V | 4822 124 20388 |
| C508 | 330 µF-63 V | 4822 124 20404 |
| C705 | 1000 µF-63 V | 4822 124 70215 |
| R15, 115 | Safety resistor 20 Ω | 4822 111 50372 |



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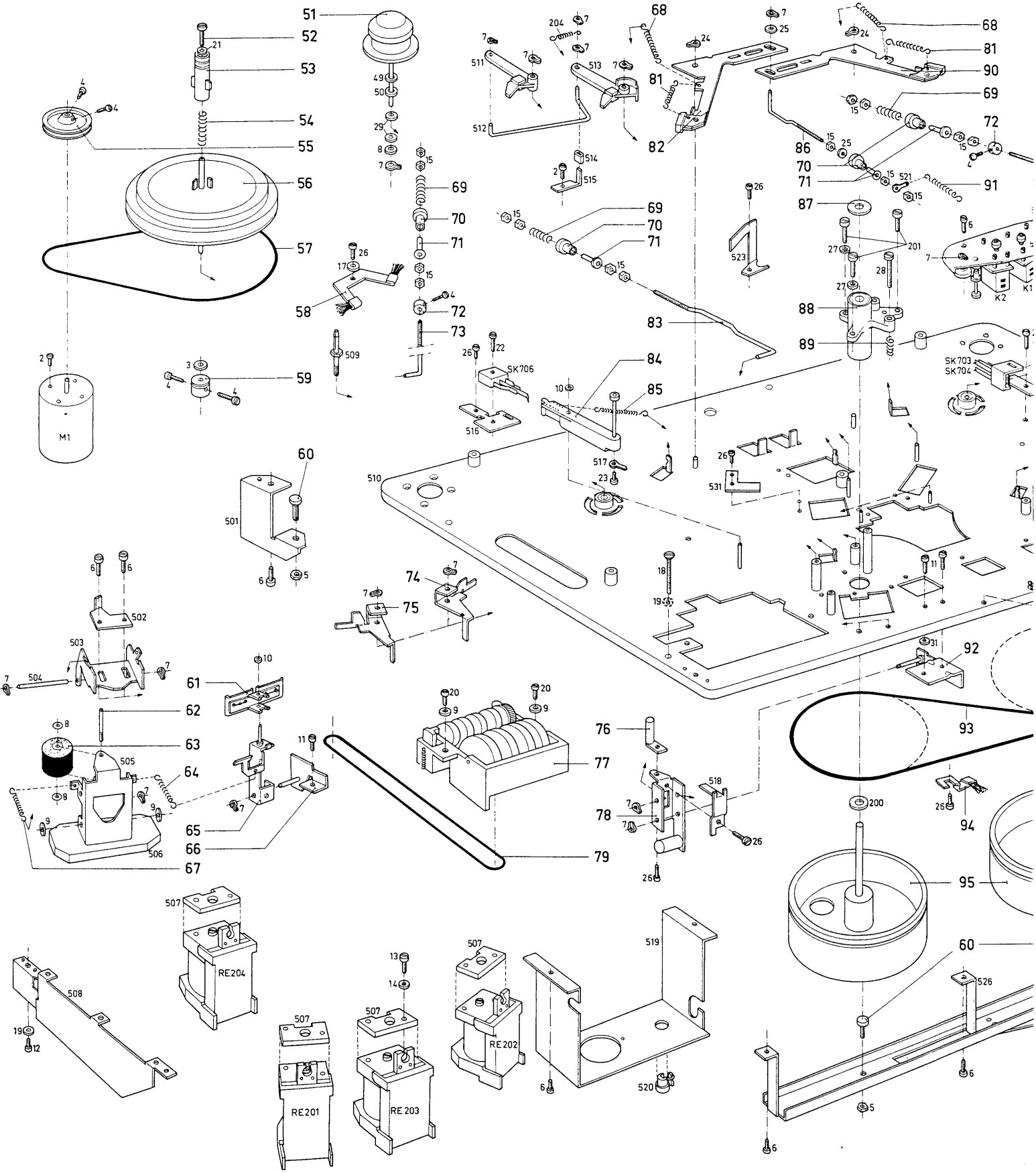
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M1
SK706
SK703
SK704
K1
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RE204
RE201
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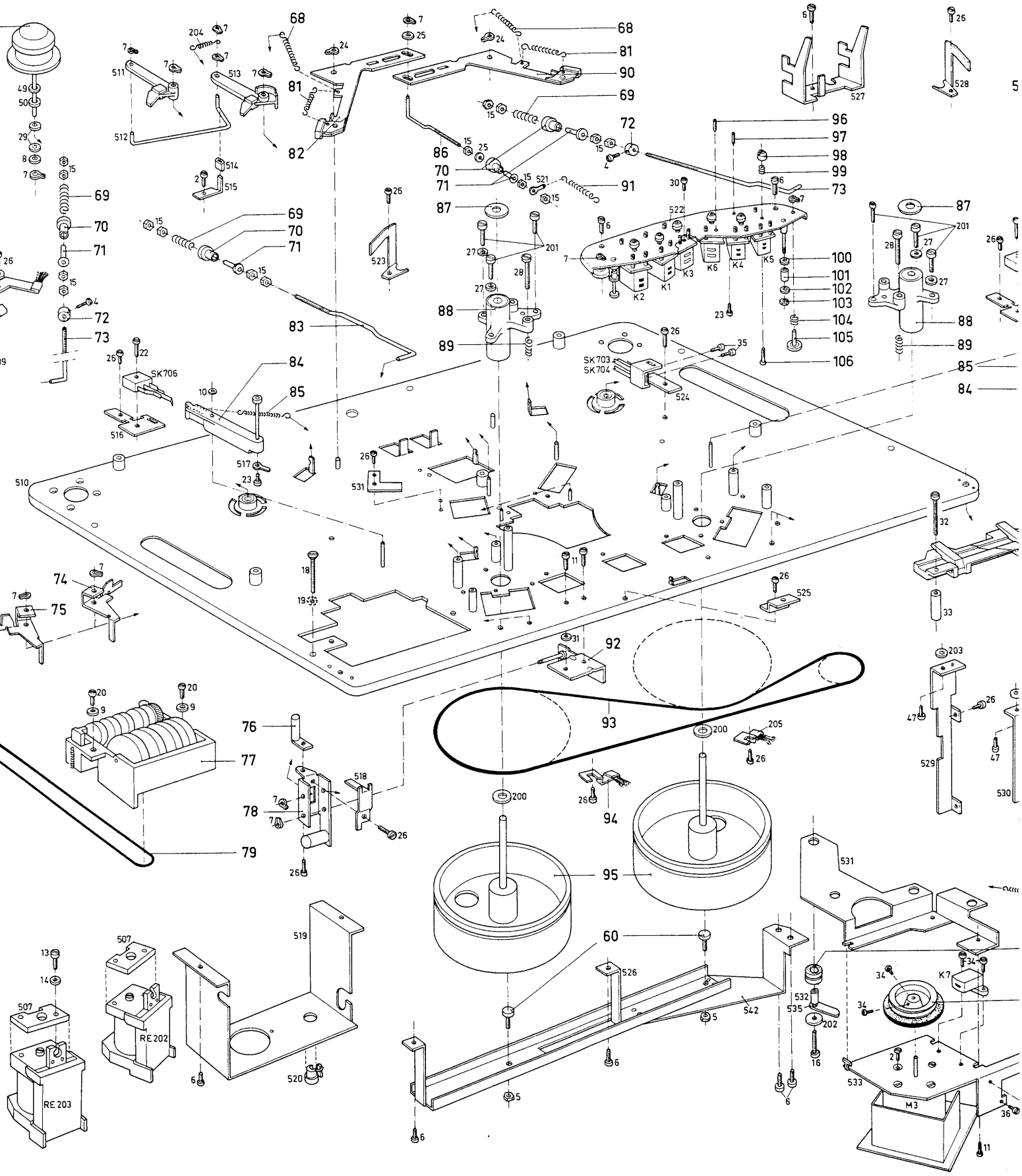
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SK703
SK704
RE 202
RE 203
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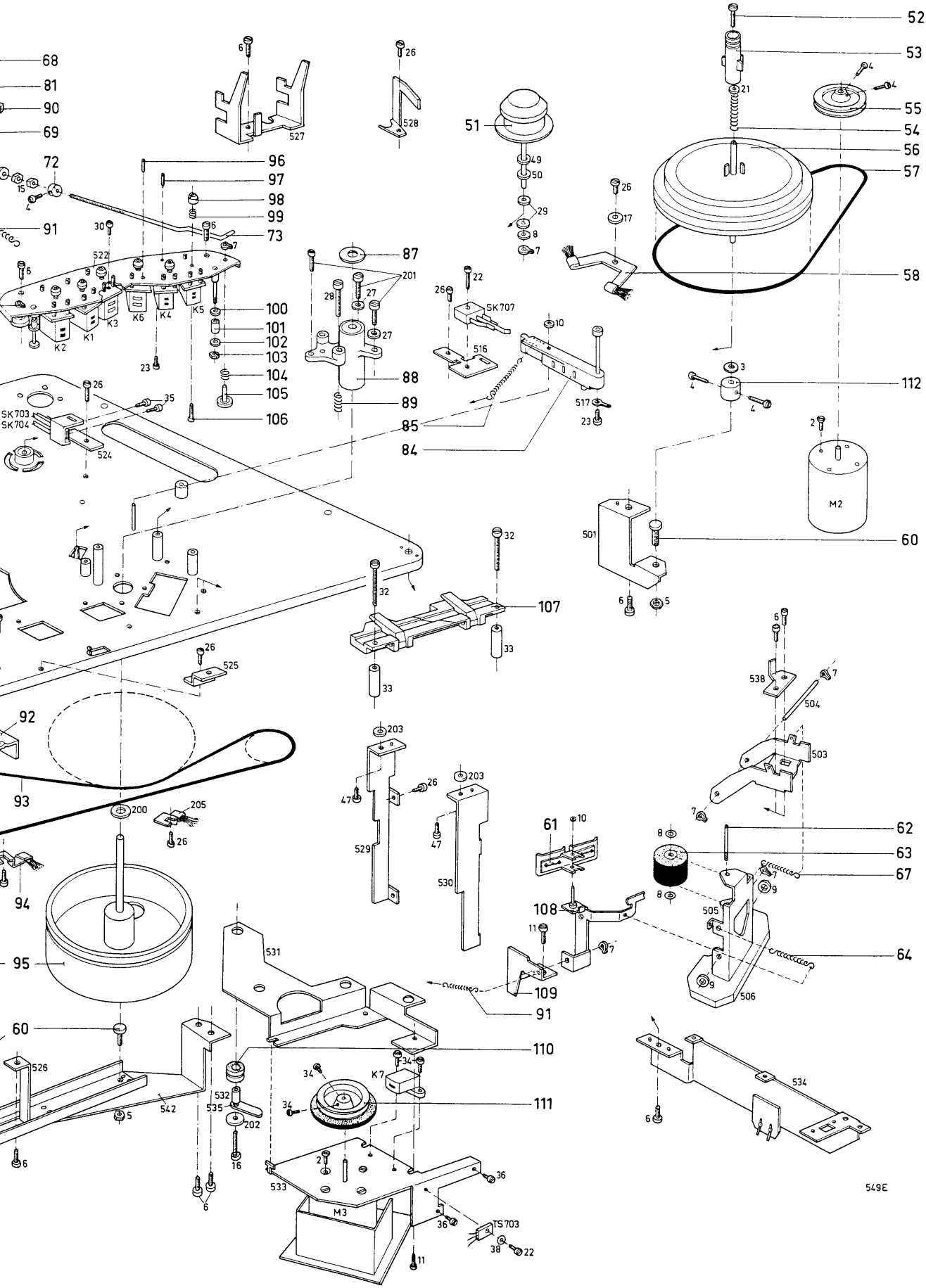
K1
K2
K3
K4
K5
K6
K7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73
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100
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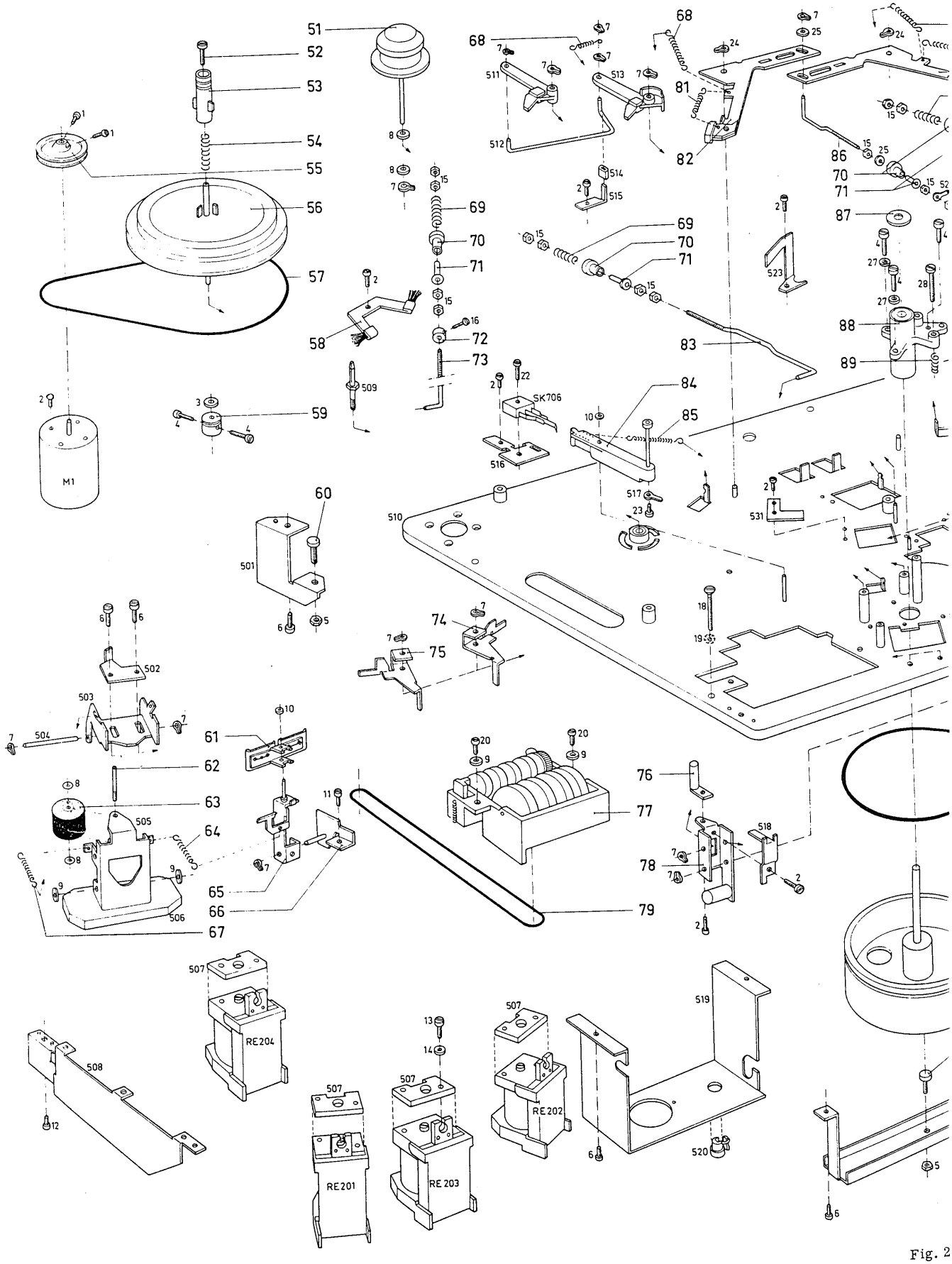
SK707
SK703
SK704
TS703
M2
M3
549E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M1
SK706
501
502
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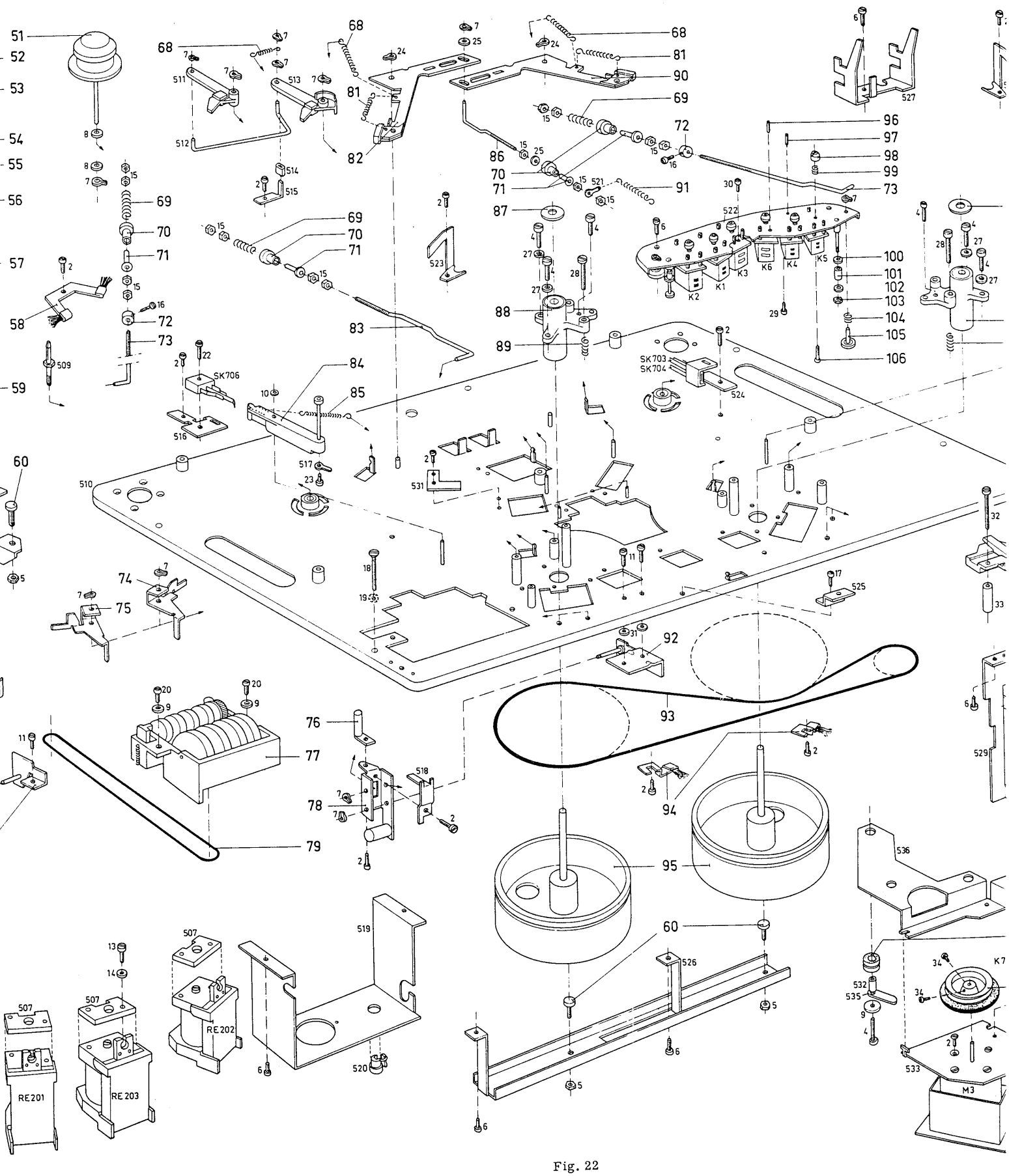
RE204
RE201
RE203
RE202

Fig. 2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SK706
SK703
SK704
K1
K2
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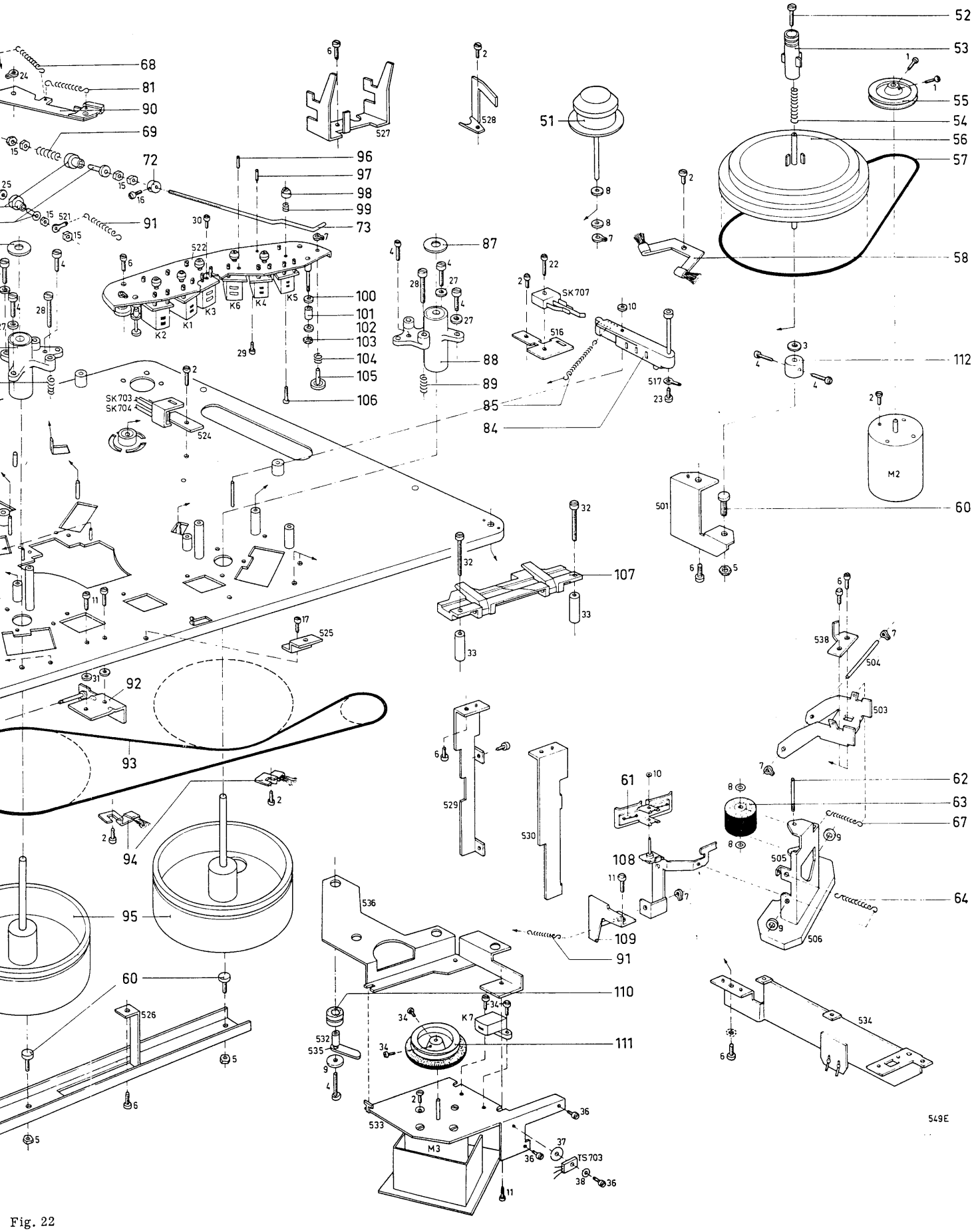
K4
K5
K6
K7
RE201
RE202
RE203
M3

Fig. 22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111
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108
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536
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527
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M2
M3
SK703
SK704
SK707
TS703
549E

Fig. 22

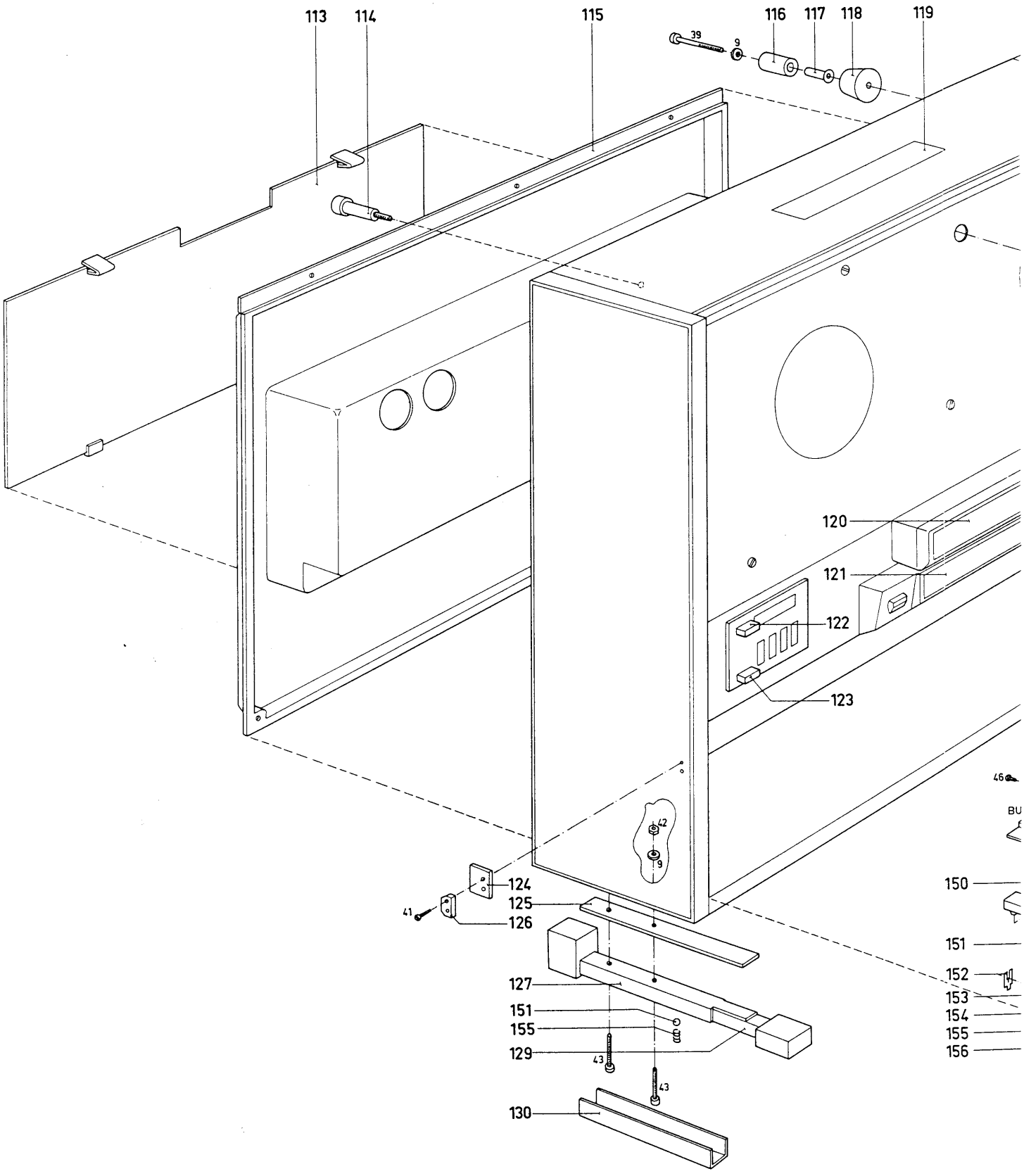
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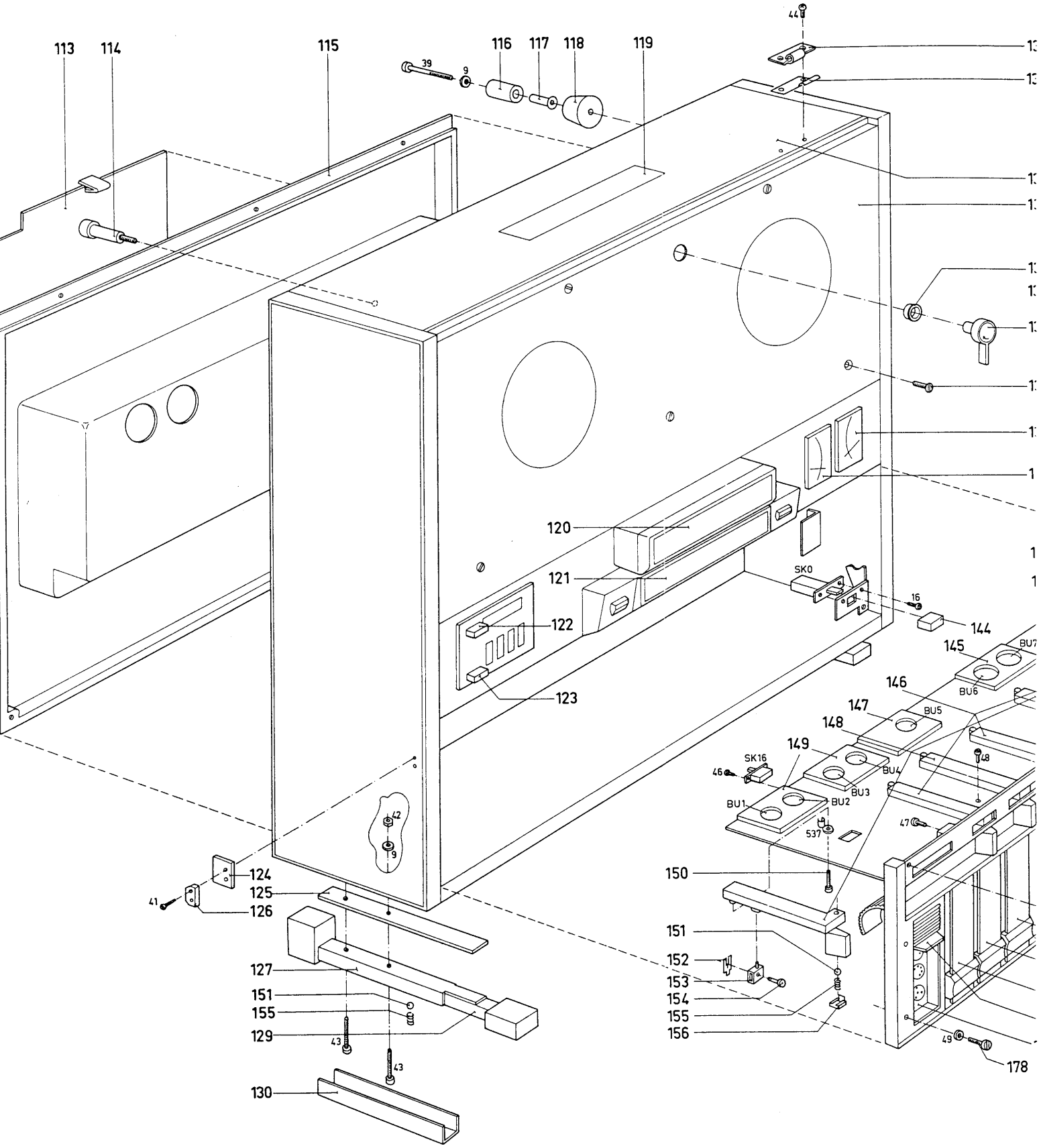
Fig. 23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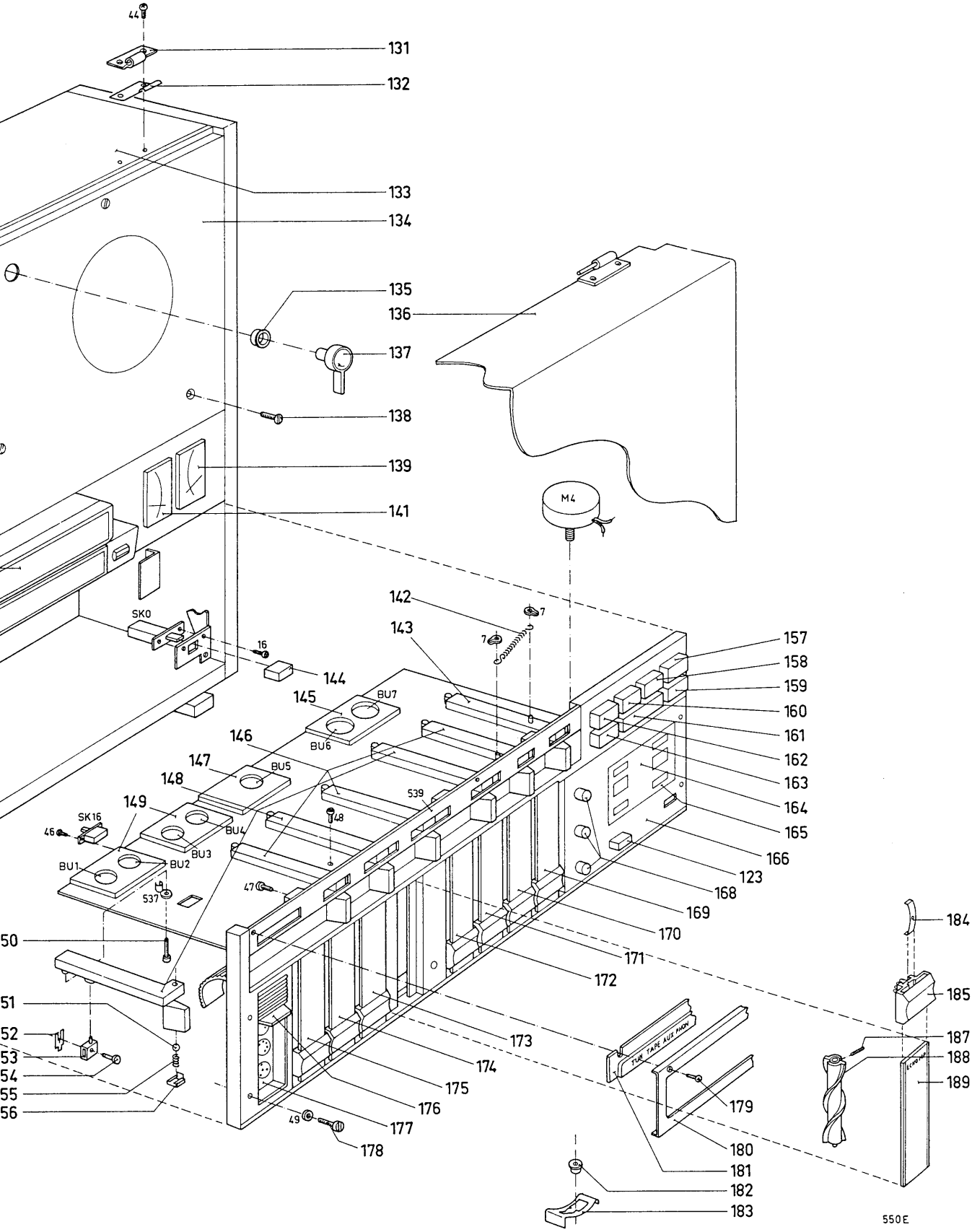
156
178
SK0
SK16
BU1
BU2
BU3
BU4
BU5
BU6
BU7
537

Fig. 23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SK0
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166
123
168
169
170
171
172
145
BU7
BU6
146
147
BU5
148
149
BU4
BU3
BU2
BU1
SK16
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537
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539
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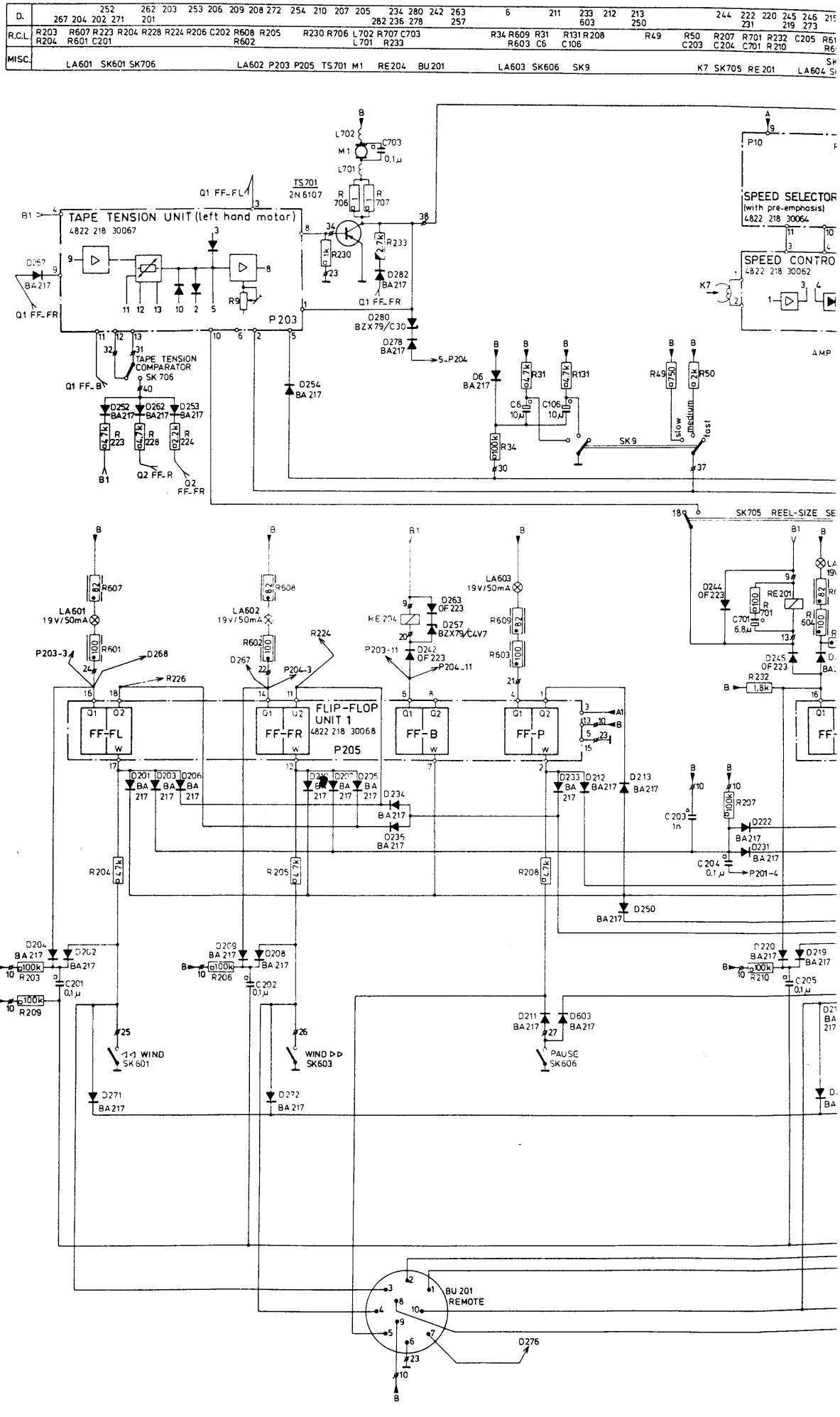
550E


D. 267 204 202 271 252 201 262 203 253 206 209 208 272 254 210 207 205 282 234 236 280 278 242 263 257 6 211 233 603 212 213 250 244 231 222 220 245 219 246 273
R.C.L. R203 R204 R607 R601 R223 C201 R204 R228 R224 R206 C202 R608 R602 R205 R230 R706 L702 L701 R707 C703 R233 R34 R609 R603 R31 C6 R131 C106 R208 R49 R50 C203 R207 C204 R701 C701 R232 R210 C205
MISC. LA601 SK601 SK706 LA602 P203 P205 TS701 M1 RE204 BU201 LA603 SK606 SK9 K7 SK705 RE201 LA604
TAPE TENSION UNIT (left hand motor)
4822 218 30067
TAPE TENSION COMPARATOR
SK 706
TS701
2N 6107
L702
M1
L701
C703
0,1µ
R 706
R 707
R230
R233
2.7k
D282
BA 217
D280
BZX79/C30
D278
BA217
D254
BA 217
D252
BA217
D262
BA217
D253
BA217
R 223
R 228
R 224
Q1 FF_FL
Q1 FF_FR
Q1 FF_B
Q2 FF_R
Q2 FF_FR
P203
5-P204
D6
BA 217
R31
R131
C6
10µ
C106
10µ
R34
SK 9
slow
medium
fast
R49
R50
SPEED SELECTOR
(with pre-emphasis)
4822 218 30064
SPEED CONTRO
4822 218 30062
AMP
SK705 REEL-SIZE SE
LA601
19V/50mA
LA602
19V/50mA
LA603
19V/50mA
R607
R608
R609
R603
R601
R602
D268
D267
D263
OF 223
D257
BZX79/C4V7
D262
OF 223
P203-3
P204-3
P203-11
P204_11
R224
R226
FLIP-FLOP
UNIT 1
4822 218 30068
P205
FF-FL
FF-FR
FF-B
FF-P
D201
D203
D206
D234
D235
D233
D212
D213
BA 217
R204
R205
R208
R207
C203
1n
C204
0,1 µ
P201-4
D222
D231
D250
D244
OF223
D245
OF223
RE201
C701
6.8µ
R 604
R 701
R232
1.8k
D204
D202
D209
D208
D220
D219
R203
R206
R210
C201
0,1µ
C202
0,1µ
C205
0,1µ
R209
D211
D603
WIND ◁◁
SK 601
WIND ▷▷
SK603
PAUSE
SK606
D271
D272
BU 201
REMOTE
D276

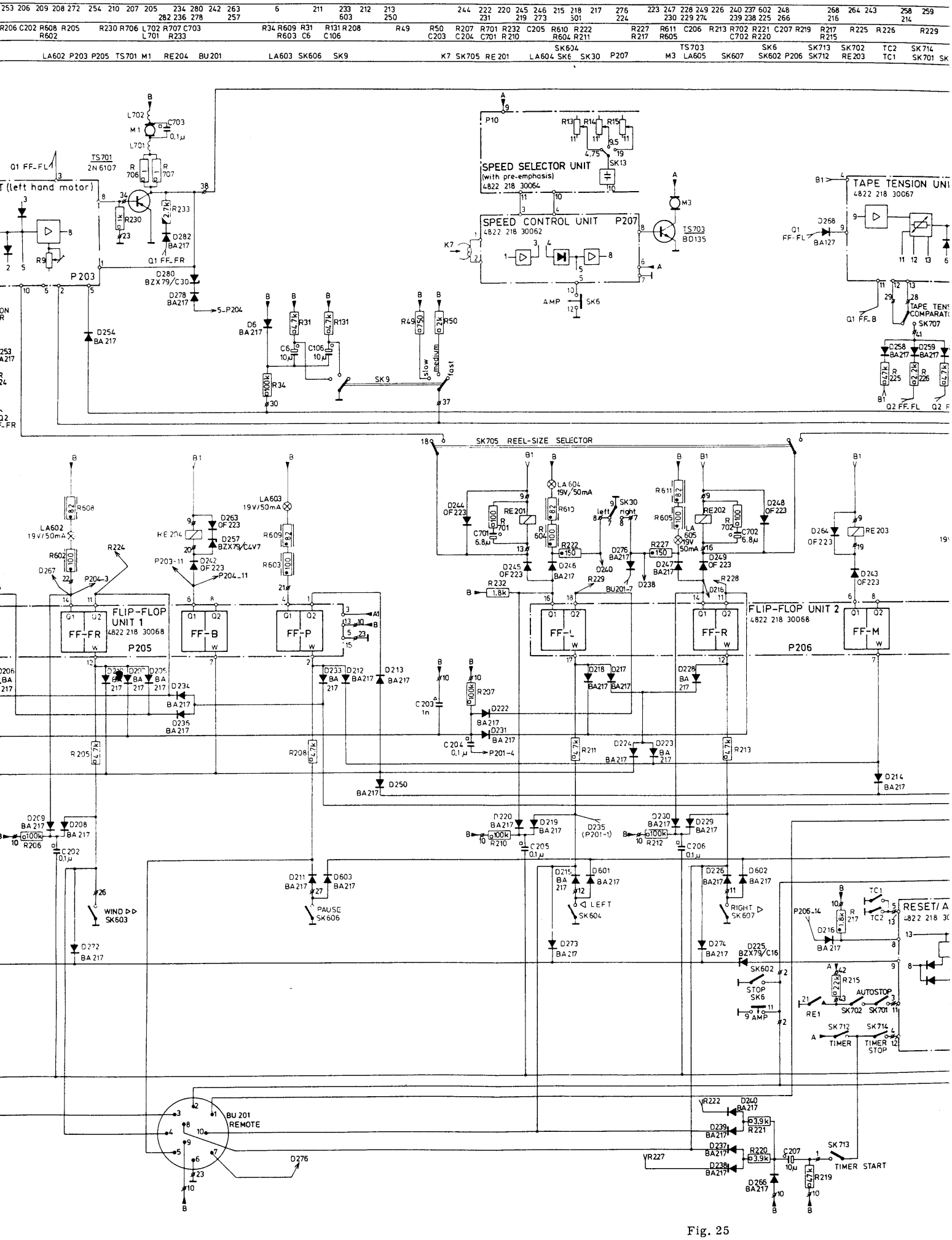

SPEED SELECTOR UNIT
(with pre-emphasis)
4822 218 30064
SPEED CONTROL UNIT P207
4822 218 30062
TAPE TENSION UNI
4822 218 30067
SK705 REEL-SIZE SELECTOR
FLIP-FLOP UNIT 1
4822 218 30068
P205
FF-FR
FF-B
FF-P
FLIP-FLOP UNIT 2
4822 218 30068
P206
FF-L
FF-R
FF-M
BU 201
REMOTE
WIND
PAUSE
LEFT
RIGHT
STOP
AUTOSTOP
TIMER
TIMER STOP
TIMER START
RESET/A

Fig. 25

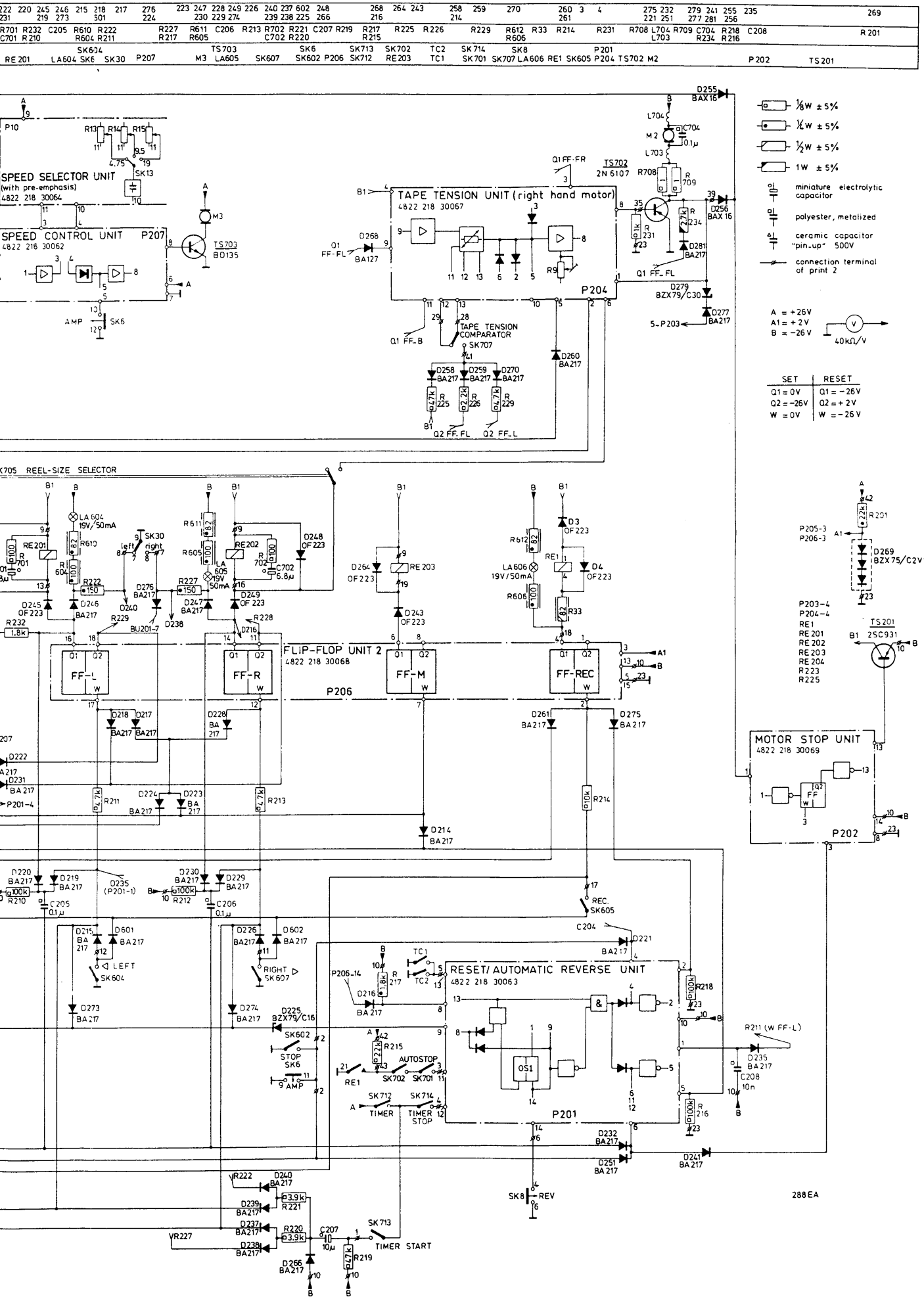

SPEED SELECTOR UNIT
(with pre-emphasis)
4822 218 30064
SPEED CONTROL UNIT P207
4822 218 30062
TAPE TENSION UNIT (right hand motor)
4822 218 30067
TAPE TENSION COMPARATOR
SK707
P204
FLIP-FLOP UNIT 2
4822 218 30068
P206
FF-L
FF-R
FF-M
FF-REC
RESET/AUTOMATIC REVERSE UNIT
4822 218 30063
P201
MOTOR STOP UNIT
4822 218 30069
P202
REEL-SIZE SELECTOR
SET | RESET
Q1 = 0V | Q1 = −26V
Q2 = −26V | Q2 = +2V
W = 0V | W = −26V
A = +26V
A1 = +2V
B = −26V
40kΩ/V
1/8W ±5%
1/4W ±5%
1/2W ±5%
1W ±5%
miniature electrolytic capacitor
polyester, metalized
ceramic capacitor "pin-up" 500V
connection terminal of print 2
TIMER START
288EA

Fig. 25

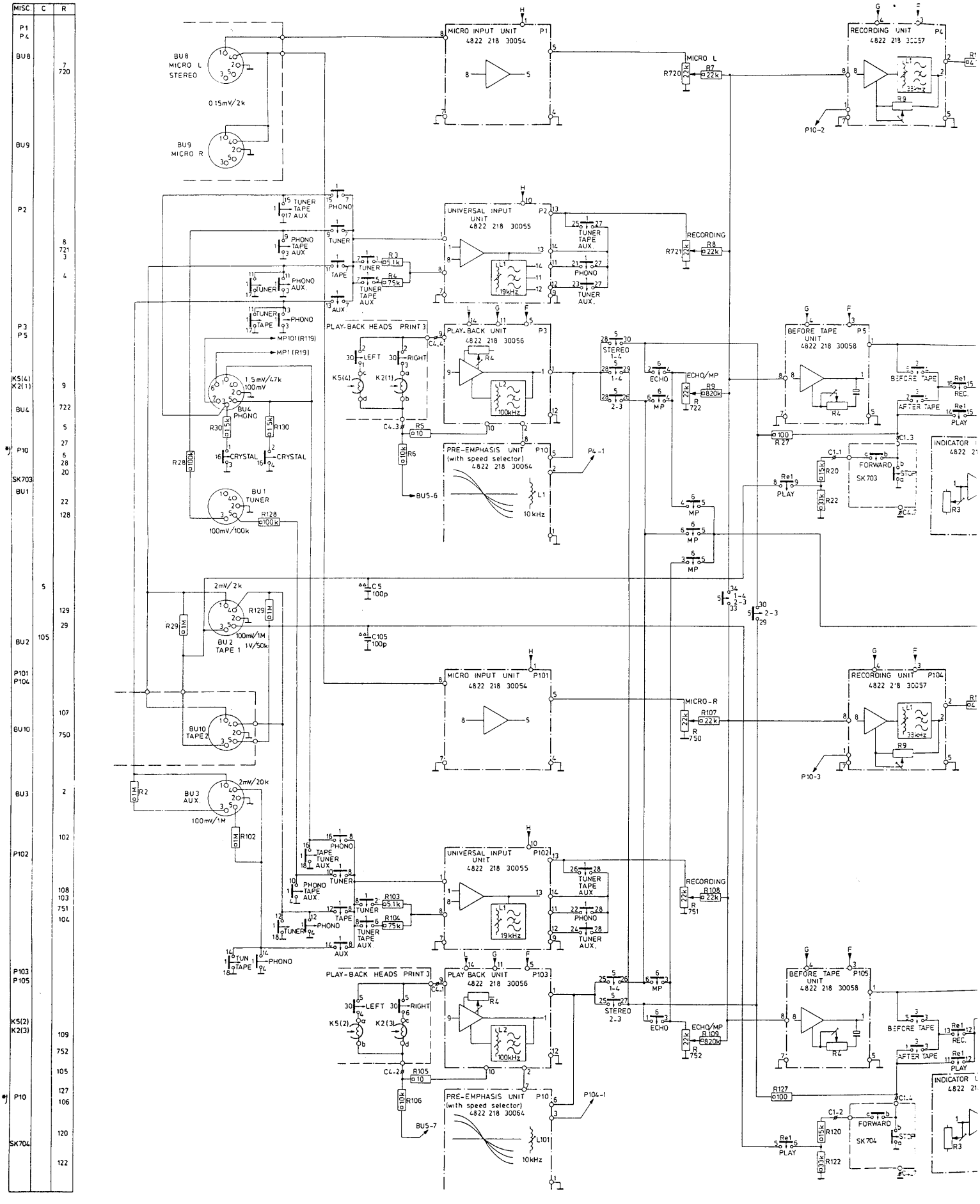

MISC
C
R
MICRO INPUT UNIT P1
4822 218 30054
MICRO INPUT UNIT P101
4822 218 30054
RECORDING UNIT P4
4822 218 30057
RECORDING UNIT P104
4822 218 30057
UNIVERSAL INPUT UNIT
4822 218 30055
PLAY-BACK UNIT
4822 218 30056
PRE-EMPHASIS UNIT
(with speed selector)
4822 218 30064
BEFORE TAPE UNIT
4822 218 30058
BU8 MICRO L STEREO
BU9 MICRO R
BU1 TUNER
BU2 TAPE 1
BU10 TAPE 2
BU3 AUX.
PLAY-BACK HEADS PRINT 3
MICRO L
MICRO-R
RECORDING
ECHO/MP
STEREO
ECHO
MP
PLAY
FORWARD
STOP
SK 703
SK 704
INDICATOR
BEFORE TAPE
AFTER TAPE
REC.
PLAY
TUNER
PHONO
TAPE
AUX.
LEFT
RIGHT
CRYSTAL
10 kHz
19kHz
100kHz
P10-2
P10-3
P4-1
P104-1
BU5-6
BU5-7

Fig. 26

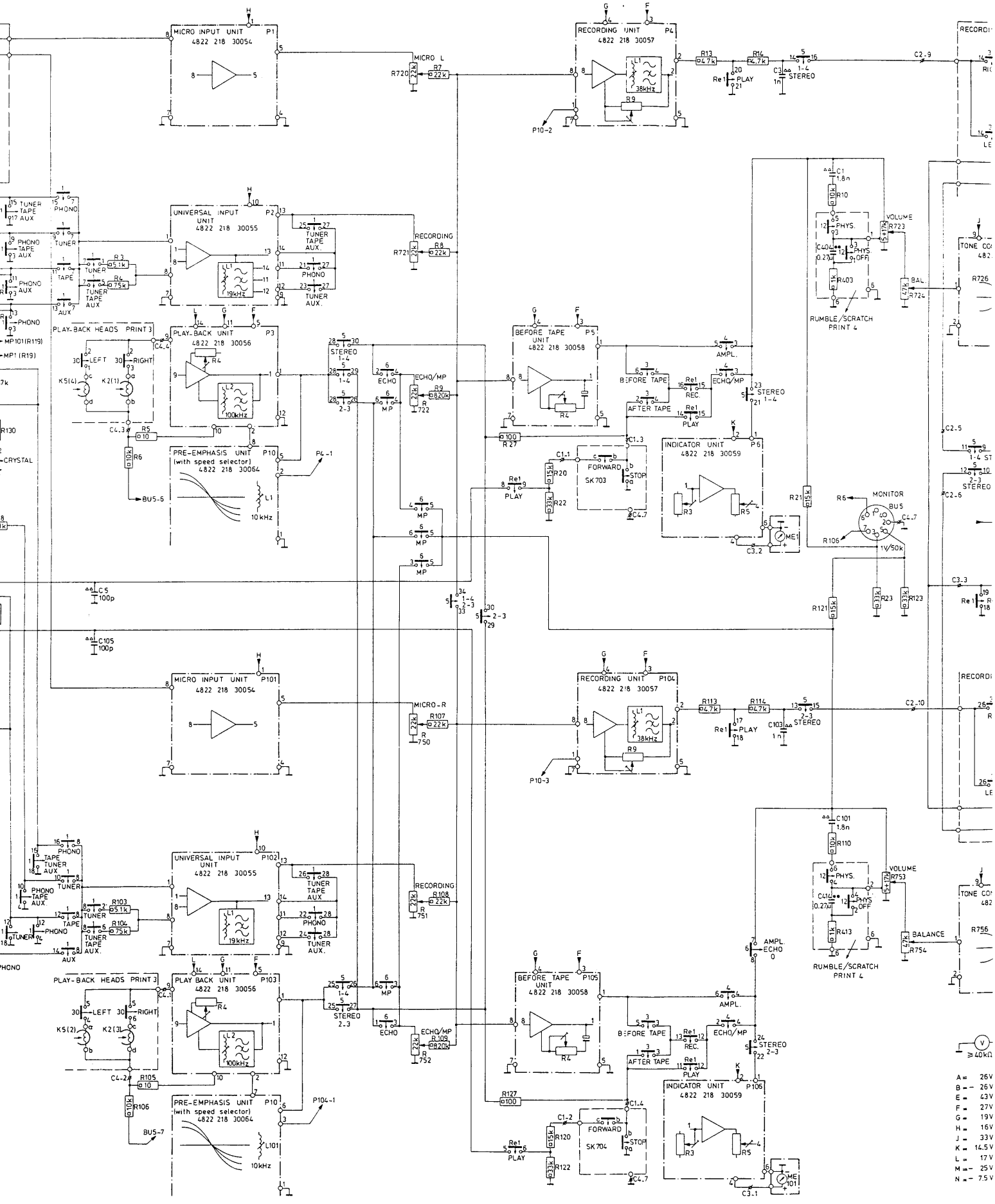
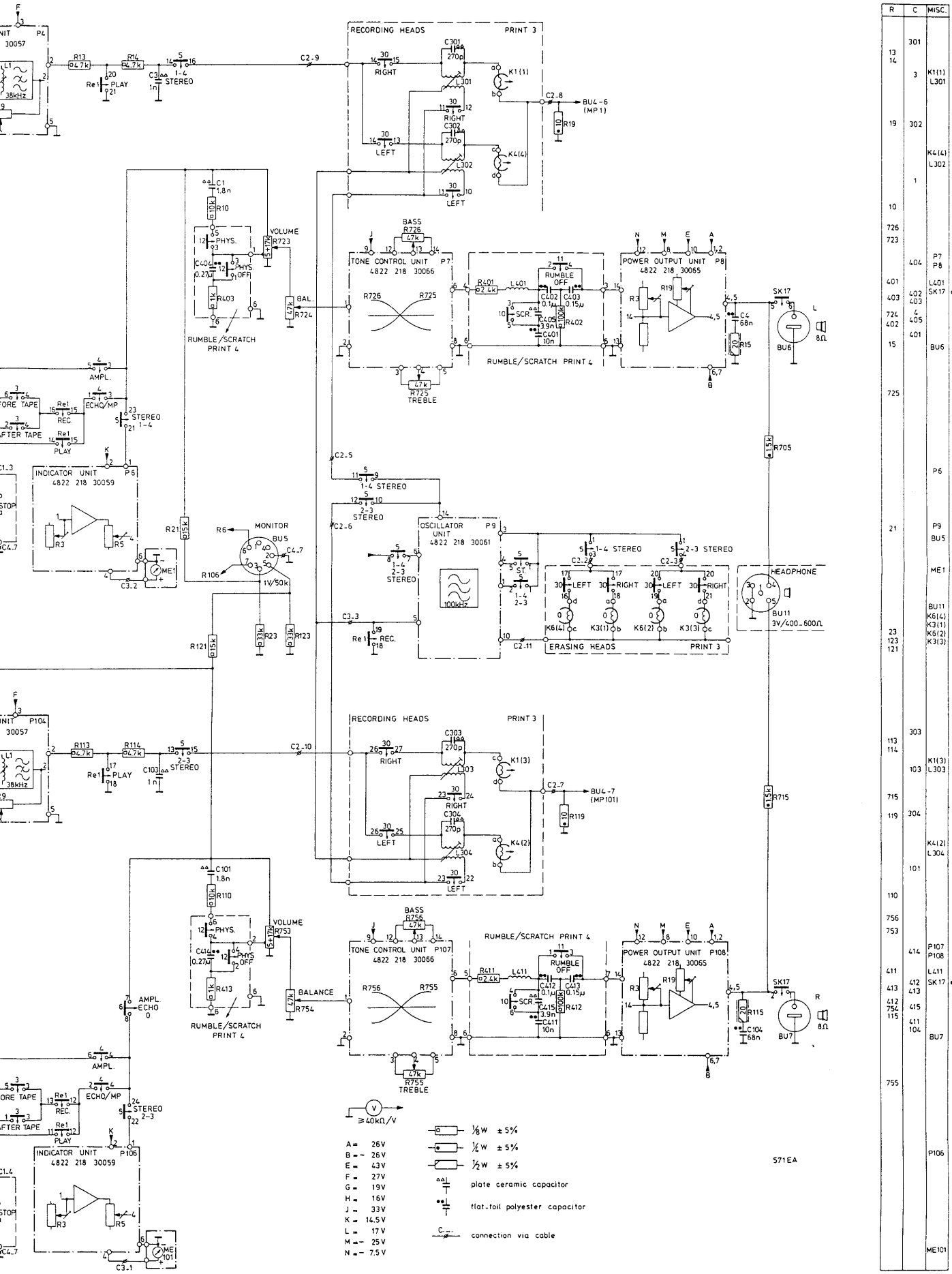

MICRO INPUT UNIT P1
4822 218 30054
MICRO L
R720 22k
R7 22k
RECORDING UNIT P4
4822 218 30057
38kHz
P10-2
R13 47k
R14 47k
Re1 PLAY
C3 1n
STEREO
C2-9
UNIVERSAL INPUT UNIT P2
4822 218 30055
19kHz
RECORDING
R721 22k
R8 22k
TUNER
TAPE
PHONO
AUX
PLAY-BACK HEADS PRINT 3
PLAY-BACK UNIT P3
4822 218 30056
100kHz
LEFT
RIGHT
K5(4)
K2(1)
R4
R5 10
R6 10k
BU5-6
PRE-EMPHASIS UNIT P10
(with speed selector)
4822 218 30064
10kHz
P4-1
STEREO
ECHO
ECHO/MP
R9 820k
R722 22k
MP
BEFORE TAPE UNIT P5
4822 218 30058
AMPL.
BEFORE TAPE
AFTER TAPE
REC.
PLAY
STEREO
R27 100
C1-3
FORWARD
STOP
SK703
R20 15k
R22 33k
C4-7
INDICATOR UNIT P6
4822 218 30059
R3
R5
ME1
C3-2
R21 15k
MONITOR
BU5
R106 1½/50k
C1 1.8n
R10 10k
VOLUME
R723 5+17k
PHYS.
PHYS. OFF
C4-4 0.27µ
R403 1k
BAL.
R724 47k
RUMBLE/SCRATCH
PRINT 4
TONE CO
R726
C2-5
C2-6
C3-3
R121 15k
R23 33k
R123 33k
C5 100p
C105 100p
MICRO INPUT UNIT P101
4822 218 30054
MICRO-R
R107 22k
R750 22k
RECORDING UNIT P104
4822 218 30057
P10-3
R113 47k
R114 47k
C103 1n
C2-10
C101 1.8n
R110 10k
R753 5+17k
C4-4 0.27µ
R413 1k
BALANCE
R754 47k
UNIVERSAL INPUT UNIT P102
4822 218 30055
R103 5.1k
R104 75k
R751 22k
R108 22k
PLAY-BACK HEADS PRINT 3
PLAY BACK UNIT P103
4822 218 30056
K5(2)
K2(3)
R105 10
R106 10k
BU5-7
PRE-EMPHASIS UNIT P10
(with speed selector)
4822 218 30064
P104-1
L101
BEFORE TAPE UNIT P105
4822 218 30058
R752 22k
R109 820k
R127 100
C1-4
C1-2
FORWARD
STOP
SK704
R120 15k
R122 33k
INDICATOR UNIT P106
4822 218 30059
C3-1
AMPL. ECHO 0
≥40kΩ
A = 26V
B = – 26V
E = 43V
F = 27V
G = 19V
H = 16V
J = 33V
K = 14.5V
L = 17V
M = – 25V
N = – 7.5V

Fig. 26




| R | C | MISC. |
|---|---|---|
| | 301 | |
| 13 | | |
| 14 | | |
| | 3 | K1(1) L301 |
| 19 | 302 | |
| | | K4(4) L302 |
| | 1 | |
| 10 | | |
| 726 | | |
| 723 | | |
| | 404 | P7 P8 |
| 401 | | L401 |
| 403 | 402 | SK17 |
| 724 | 403 | |
| 402 | 4 405 | |
| | 401 | |
| 15 | | BU6 |
| 725 | | |
| | | P6 |
| 21 | | P9 |
| | | BU5 |
| | | ME1 |
| | | BU11 |
| | | K6(4) |
| | | K3(1) |
| 23 | | K6(2) |
| 123 | | K3(3) |
| 121 | | |
| | 303 | |
| 113 | | |
| 114 | | K1(3) |
| | 103 | L303 |
| 715 | | |
| 119 | 304 | |
| | | K4(2) L304 |
| | 101 | |
| 110 | | |
| 756 | | |
| 753 | | |
| | 414 | P107 P108 |
| 411 | | L411 |
| 413 | 412 | SK17 |
| 412 | 413 | |
| 754 | | |
| 115 | 415 | |
| | 411 | |
| | 104 | BU7 |
| 755 | | |
| | | P106 |
| | | ME101 |

A = 26V
B = ~ 26V
E = 43V
F = 27V
G = 19V
H = 16V
J = 33V
K = 14.5V
L = 17V
M = ~ 25V
N = ~ 7.5V

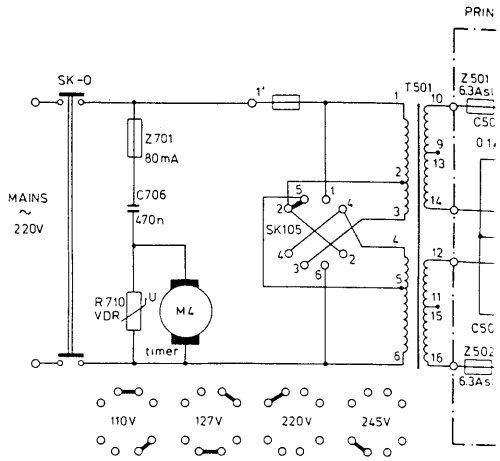
Fig. 26

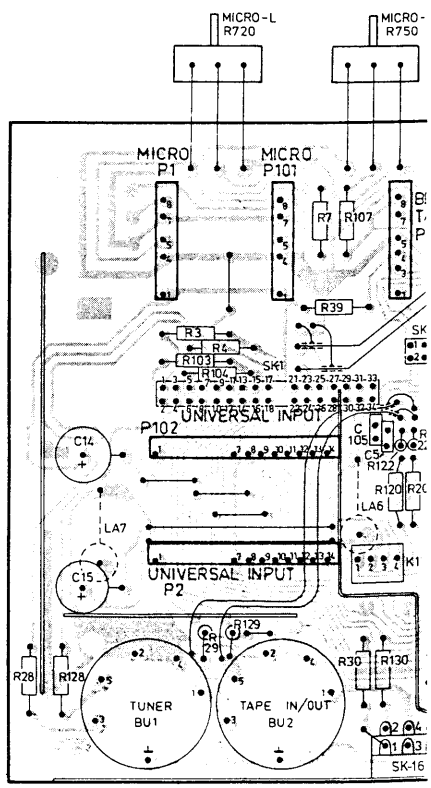
## II. Supply

| | | |
|---|---|---|
| SK0 | Mains switch | 4822 276 10483 |
| SK105 | Mains voltage selector | 4822 272 10102 |
| M4 | Timer motor | 4822 361 60185 |
| L1, 2, 3, 4, 5, 6, 7, 8, 9, 701, 702 | Lamp 28 V - 40 mA | 4822 134 40127 |
| R710 | VDR-resistor | 4822 116 20103 |
| T501 | Mains transformer | 4822 146 40197 |

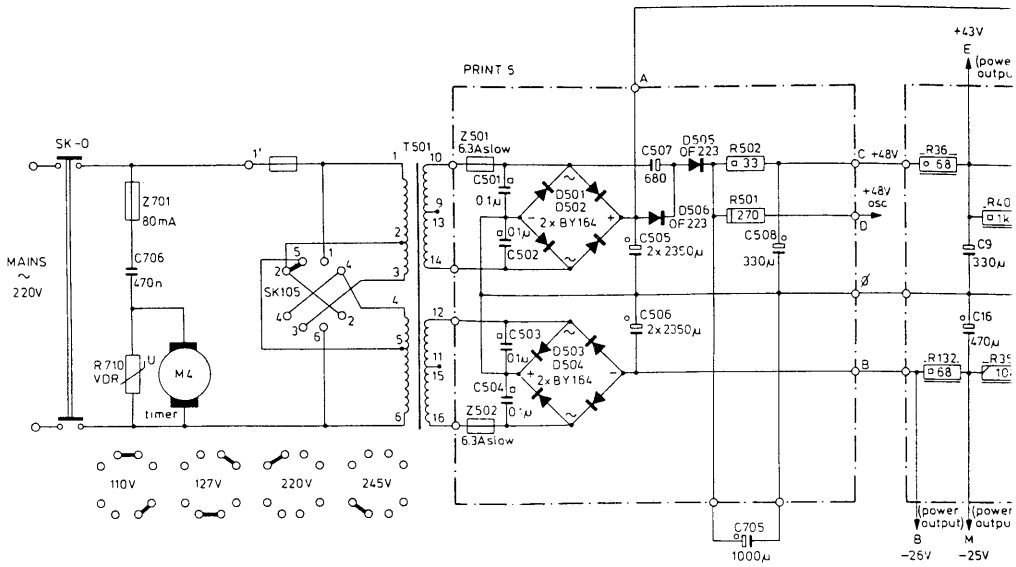
## III. Amplifier part

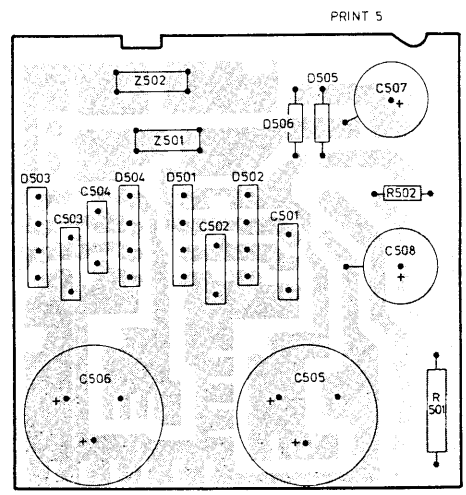
| | | |
|---|---|---|
| P1, 101 | Micro input unit | 4822 218 30054 |
| P2, 102 | Universal input unit | 4822 218 30055 |
| P3, 103 | Play-back unit | 4822 218 30056 |
| P4, 104 | Recording unit | 4822 218 30057 |
| P5, 105 | Before tape unit | 4822 218 30058 |
| P6, 106 | Indicator unit | 4822 218 30059 |
| P7, 107 | Tone control unit | 4822 218 30066 |
| P8, 108 | Power output unit | 4822 218 30065 |
| P9 | Oscillator unit | 4822 218 30061 |
| P10 | Speed selector/pre-emphasis unit | 4822 218 30064 |
| SK1 | Slide switch (TUN-TAPE-AUX-PHON) | 4822 277 30494 |
| SK3 | Slide switch (AB) | 4822 277 30378 |
| SK4 | Slide switch (MP-NOR-ECH-AMP) | 4822 277 30495 |
| SK5 | Slide switch (1-4 ST 3-2) | 4822 277 30496 |
| SK6 | Slide switch (MP-NOR-ECH-AMP) | 4822 277 30497 |
| SK10, 11, 12 | Push button switch assy (SCRATCH-RUMBLE-PHYS) | 4822 276 30201 |
| SK16 | Switch (CRYST-DYN) | 4822 277 60119 |
| SK30 | Slide switch (head switch) | 4822 277 60118 |
| BU1, 2, 3 | Socket, 5p (TUNER, TAPE IN/OUT, AUX) | 4822 267 40174 |
| BU4, 5 | Socket, 7p (PHONO, MONITOR) | 4822 267 50148 |
| BU6, 7 | Socket, 2p (LOUDSP L, R) | 4822 267 30233 |
| BU8, 9, 10 | see list of mechanical parts, cabinet and amplifier unit | |
| BU11 | Socket, 5p (HEADPH) | 4822 267 40175 |
| K1, 4 | Recording head | 4822 249 20032 |
| K2, 5 | Play-back head | 4822 249 30032 |
| K3, 6 | Erase head | 4822 249 40058 |
| L301, 302, 303, 304 | Coil p.c. board 3 | 4822 156 40557 |
| L401, 411 | Coil p.c. board 4 | 4822 156 20594 |
| R720, 750 | Potentiometer (MICRO) 22 kΩ, log | 4822 101 30266 |
| R721/751, 722/752 | Potentiometer (PHONO, ECHO) 22 kΩ, log | 4822 102 30178 |
| R723/753 | Potentiometer (VOLUME) 5+17 kΩ, log | 4822 102 30179 |
| R724/754 | Potentiometer (BALANCE) 47 kΩ | 4822 102 30168 |
| R725/755, 726/756 | Potentiometer (TREBLE, BASS) 47 kΩ linear | 4822 102 30177 |
| ME1 | Meter, left | 4822 347 10069 |
| ME101 | Meter, right | 4822 347 10071 |
| | Socket for functional unit, 14p | 4822 267 50151 |
| | Socket for functional unit, 8p | 4822 267 50156 |
| | Socket for functional unit, 3p | 4822 267 50161 |
| | Connector for wire form, 14p | 4822 267 50163 |
| | Connector for wire form, 4p | 4822 267 40179 |
| Z501, 502 | Fuse 6, 3 A-T | 4822 253 30031 |
| Z701 | Fuse 80 mA | 4822 253 20005 |
| D1 | Zenerdiode BZX79/C7V5 | 4822 130 30666 |
| D2 | Zenerdiode BZX79/C15 | 4822 130 30781 |
| D501, 502, 503, 504 | Diode BY164 | 4822 130 30414 |
| D505, 506 | Diode OF223 | 4822 130 30791 |
| C9 | 330 µF - 63 V | 4822 124 20404 |
| C10, 11 | 680 µF - 40 V | 4822 124 20413 |
| C12 | 1000 µF - 25 V | 4822 124 20419 |
| C13 | 150 µF - 25 V | 4822 124 20394 |
| C14, 15 | 220 µF - 25 V | 4822 124 20398 |
| C16 | 470 µF - 40 V | 4822 124 20407 |
| C505, 506 | 2 x 2350 µF - 40 V | 4822 124 70226 |
| C507 | 680 µF - 40 V | 4822 124 20413 |
| C706 | 470 nF - 630 V | 4822 121 40331 |





| | |
|---|---|
| | 4822 276 10483 |
| tor | 4822 272 10102 |
| | 4822 361 60185 |
| | |
| | 4822 134 40127 |
| | 4822 116 20103 |
| | 4822 146 40197 |
| | |
| | |
| | |
| | 4822 218 30054 |
| | 4822 218 30055 |
| | 4822 218 30056 |
| | 4822 218 30057 |
| | 4822 218 30058 |
| | 4822 218 30059 |
| | 4822 218 30066 |
| | 4822 218 30065 |
| | 4822 218 30061 |
| emphasis | |
| | 4822 218 30064 |
| | |
| PHON) | 4822 277 30494 |
| | 4822 277 30378 |
| | |
| P) | 4822 277 30495 |
| 3-2) | 4822 277 30496 |
| | |
| P) | 4822 277 30497 |
| asey | |
| E-PHYS) | 4822 276 30201 |
| N) | 4822 277 60119 |
| witch) | 4822 277 60118 |
| | |
| OUT, AUX) | 4822 267 40174 |
| | |
| R) | 4822 267 50148 |
| P L, R) | 4822 267 30233 |
| cal parts, cabinet and | |
| | |
| H) | 4822 267 40175 |
| | 4822 249 20032 |
| | 4822 249 30032 |
| | 4822 249 40058 |
| | |
| | 4822 156 40557 |
| | 4822 156 20594 |
| RO) | |
| | 4822 101 30266 |
| ONO, ECHO) | |
| | 4822 102 30178 |
| LUME) | |
| | 4822 102 30179 |
| LANCE) | |
| | 4822 102 30168 |
| | |
| 7 kΩ linear | 4822 102 30177 |
| | 4822 347 10069 |
| | 4822 347 10071 |
| l unit, 14p | 4822 267 50151 |
| l unit, 8p | 4822 267 50156 |
| l unit, 3p | 4822 267 50161 |
| form, 14p | 4822 267 50163 |
| form, 4p | 4822 267 40179 |
| | |
| | 4822 253 30031 |
| | 4822 253 20005 |
| /C7V5 | 4822 130 30666 |
| /C15 | 4822 130 30781 |
| | |
| | 4822 130 30414 |
| | 4822 130 30791 |
| | |
| | 4822 124 20404 |
| | 4822 124 20413 |
| | 4822 124 20419 |
| | 4822 124 20394 |
| | 4822 124 20398 |
| | 4822 124 20407 |
| | 4822 124 70226 |
| | 4822 124 20413 |
| | 4822 121 40331 |



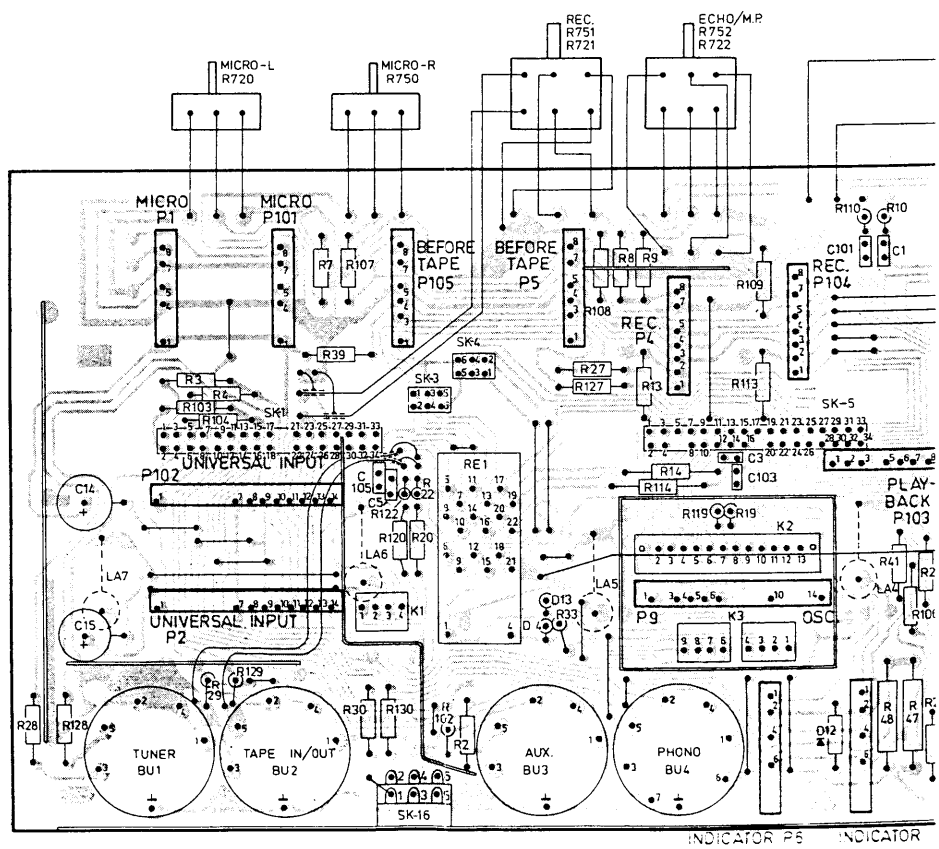
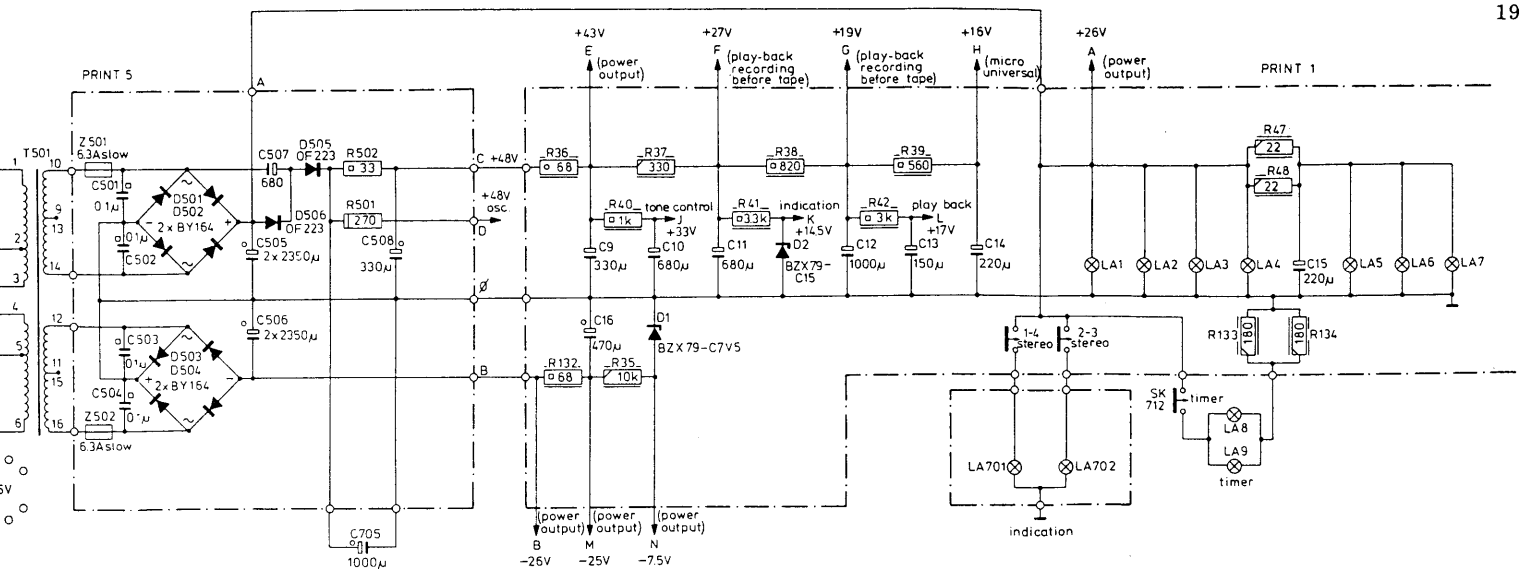
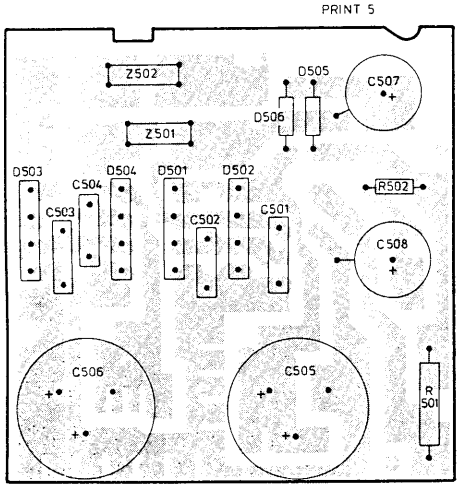




Fig. 27



V 40kΩ/V

A = + 26 V
B = − 26 V
C = + 48 V
D = + 50 V
E = + 43 V
F = + 27 V
G = + 19 V
H = + 16 V
J = + 33 V
K = + 14.5 V
L = + 17 V
M = − 25 V
N = − 7.5 V

1/8 W ± 5%
1/4 W ± 5%
1/2 W ± 5%
5.5 W ± 5%
POLYESTER CAPACITOR 250 V
MINIATURE ELECTROLYTIC CAPACITOR
LAMP 28V/ 40mA

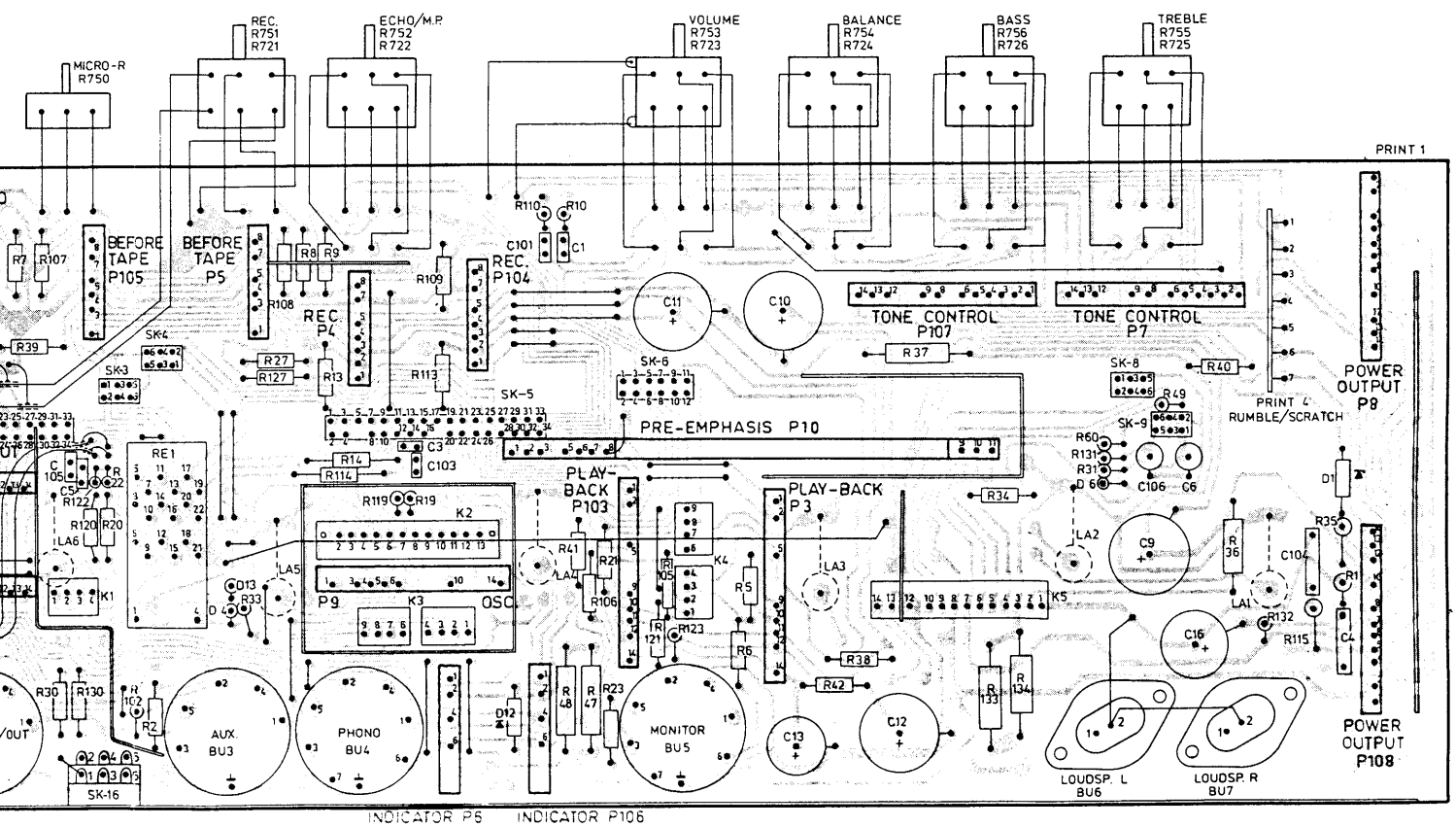



Fig. 27

585FA CS32898a

| | | |

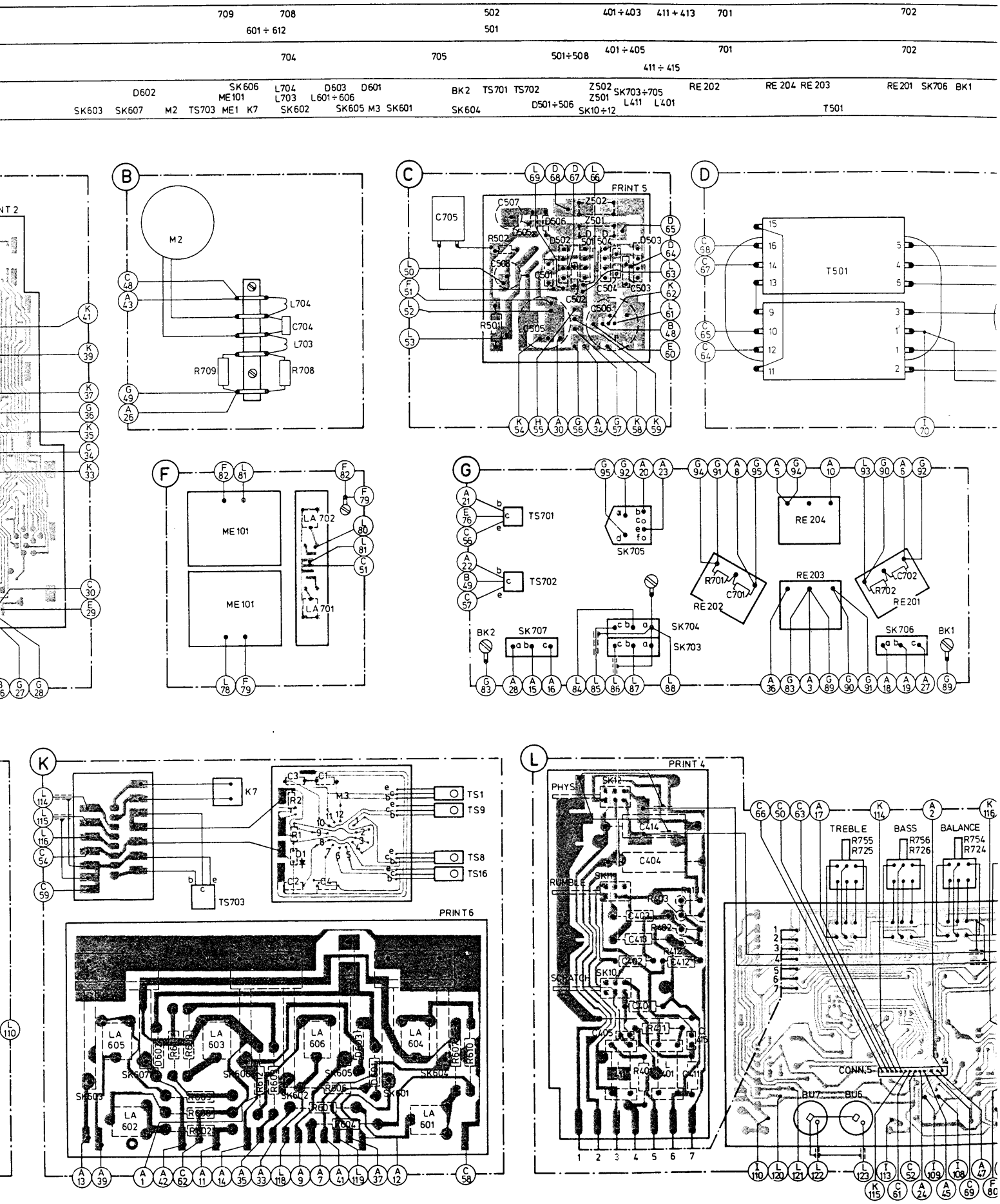
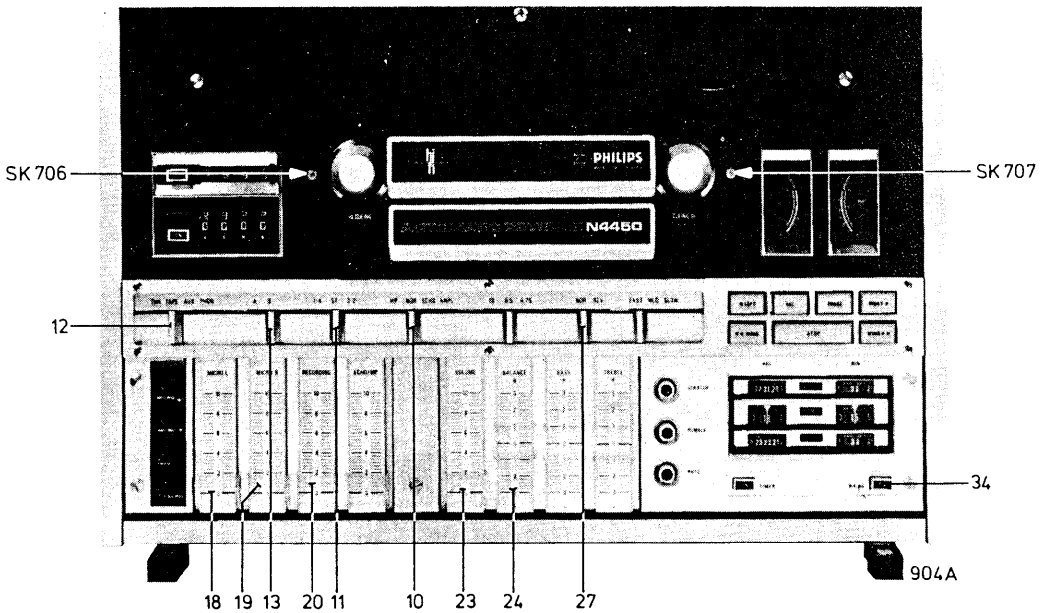
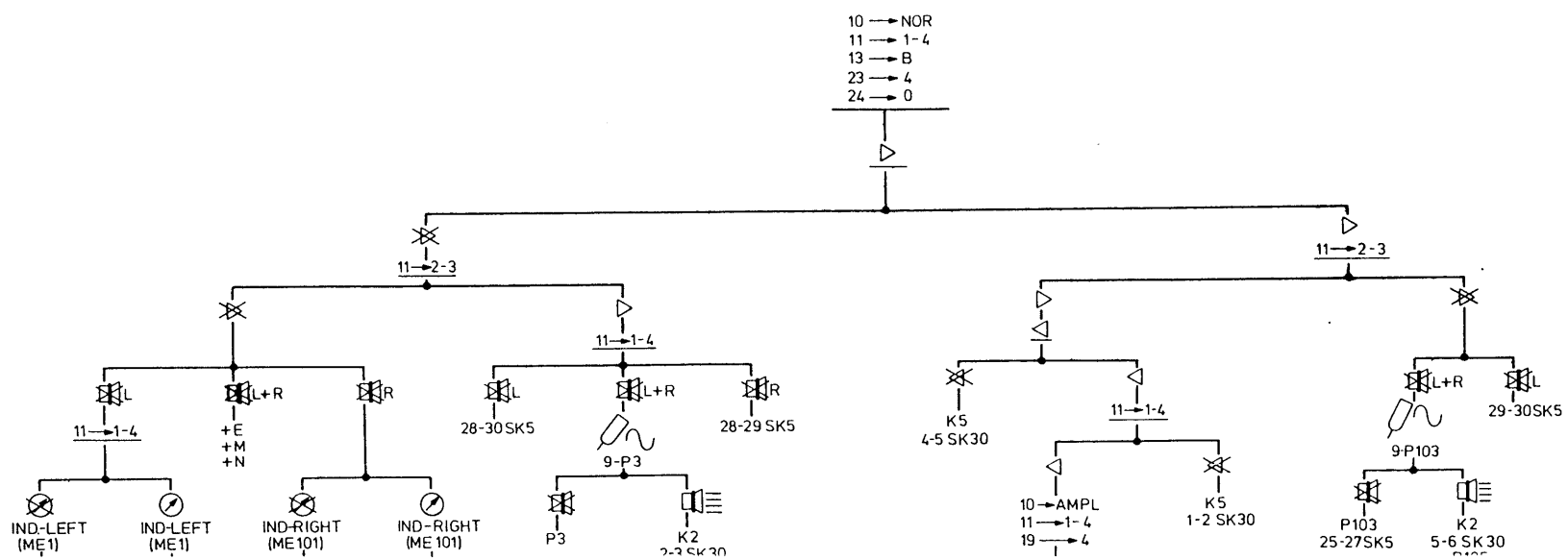
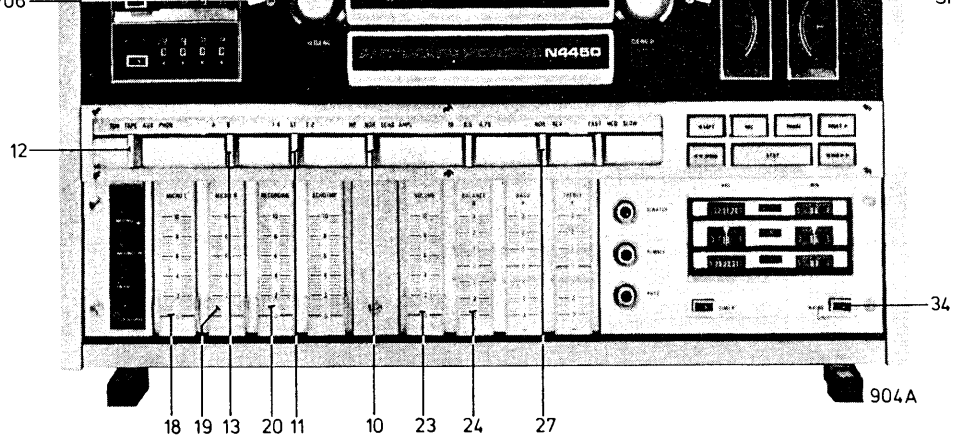

709
708
601 ÷ 612
502
501
401 ÷ 403
411 ÷ 413
701
702
704
705
501 ÷ 508
401 ÷ 405
411 ÷ 415
701
702
D602
SK606
ME101
L704
L703
D603
L601 ÷ 606
D601
BK2
TS701
TS702
Z502
Z501
SK703 ÷ 705
L411
L401
RE 202
RE 204
RE 203
RE 201
SK706
BK1
SK603
SK607
M2
TS703
ME1
K7
SK602
SK605
M3
SK601
SK604
D501 ÷ 506
SK10 ÷ 12
T501
B
M2
L704
C704
L703
R709
R708
C
PRINT 5
C705
C507
Z502
Z501
D506
D505
D502
D501
D504
D503
C508
C501
C504
C503
C502
C506
C505
R502
R501
D
T501
F
ME 101
ME 101
LA 702
LA 701
G
TS701
TS702
SK705
RE 204
RE 203
RE 202
RE 201
R701
C701
C702
R702
BK2
SK707
SK704
SK703
SK706
BK1
K
K7
TS703
TS1
TS9
TS8
TS16
PRINT 6
LA 605
LA 603
LA 606
LA 604
LA 602
LA 601
L
PRINT 4
PHYSIO
RUMBLE
SCRATCH
C414
C404
C402
C412
C407
C405
C401
C411
TREBLE
BASS
BALANCE
R755
R725
R756
R726
R754
R724
CONN.5
BU7
BU6

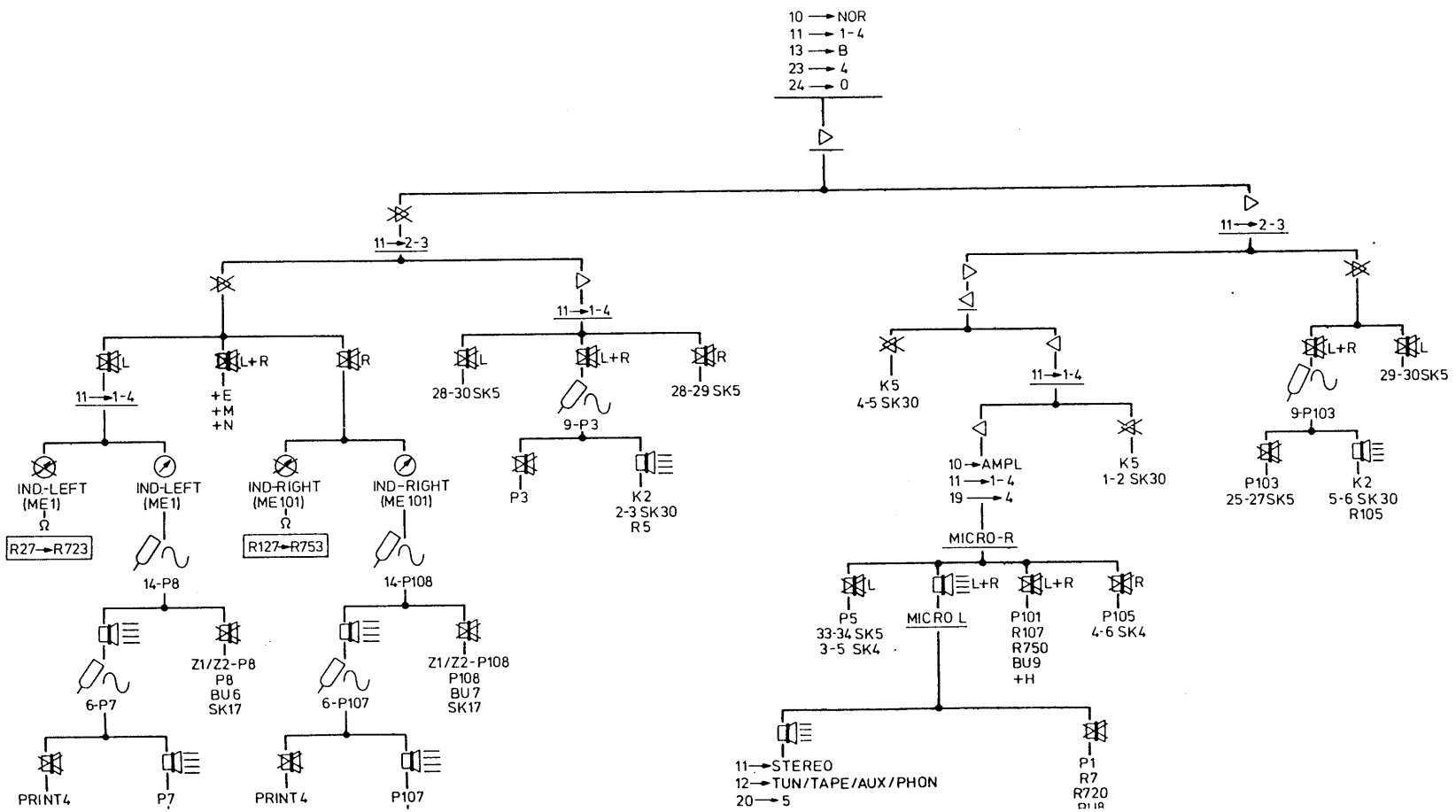
Fig. 28

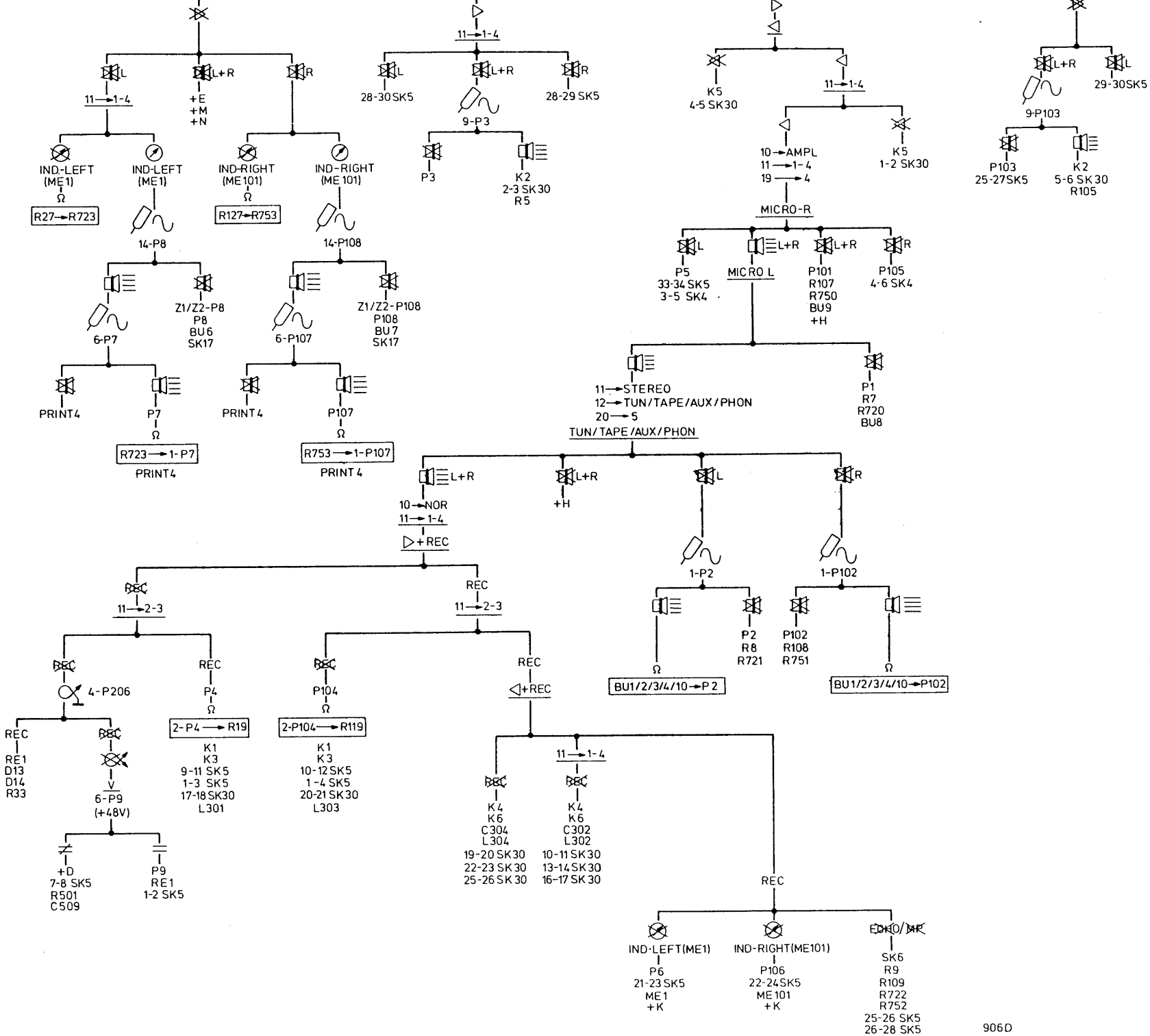
| | | |


SK 706
SK 707
12
34
904A
18
19
13
20
11
10
23
24
27


10 → NOR
11 → 1-4
13 → B
23 → 4
24 → 0
11→2-3
11→2-3
11→1-4
11→1-4
11→1-4
L
L+R
R
+E
+M
+N
28-30 SK5
9-P3
28-29 SK5
P3
K2
2-3 SK30
IND-LEFT (ME1)
IND-LEFT (ME1)
IND-RIGHT (ME101)
IND-RIGHT (ME101)
K5
4-5 SK30
10 → AMPL
11 → 1-4
19 → 4
K5
1-2 SK30
L+R
L
29-30 SK5
9-P103
P103
25-27 SK5
K2
5-6 SK30


N4450
12
34
18
19
13
20
11
10
23
24
27
904A


10 → NOR
11 → 1-4
13 → B
23 → 4
24 → 0
11→2-3
11→2-3
11→1-4
L
L+R
R
11→1-4
+E
+M
+N
28-30 SK5
9-P3
28-29 SK5
IND-LEFT (ME1) Ω
R27→R723
IND-LEFT (ME1)
IND-RIGHT (ME101) Ω
R127→R753
IND-RIGHT (ME101)
P3
K2 2-3 SK30 R5
14-P8
14-P108
6-P7
Z1/Z2-P8 P8 BU6 SK17
6-P107
Z1/Z2-P108 P108 BU7 SK17
PRINT4
P7
PRINT4
P107
K5 4-5 SK30
11→1-4
10→AMPL
11→1-4
19→4
K5 1-2 SK30
MICRO-R
P5 33-34 SK5 3-5 SK4
MICRO L
P101 R107 R750 BU9 +H
P105 4-6 SK4
11→STEREO
12→TUN/TAPE/AUX/PHON
20→5
P1 R7 R720
L+R
L
29-30 SK5
9-P103
P103 25-27 SK5
K2 5-6 SK30 R105

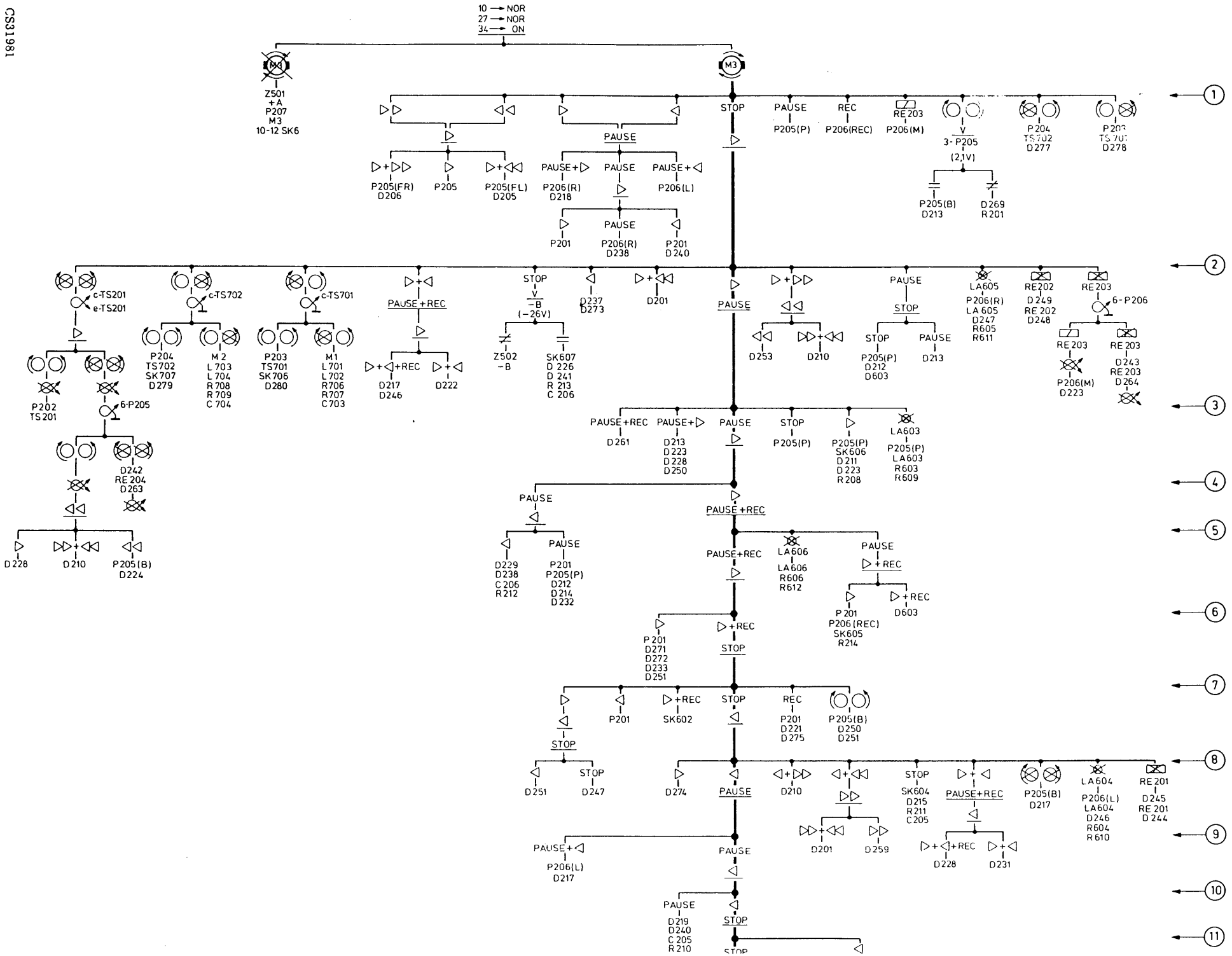


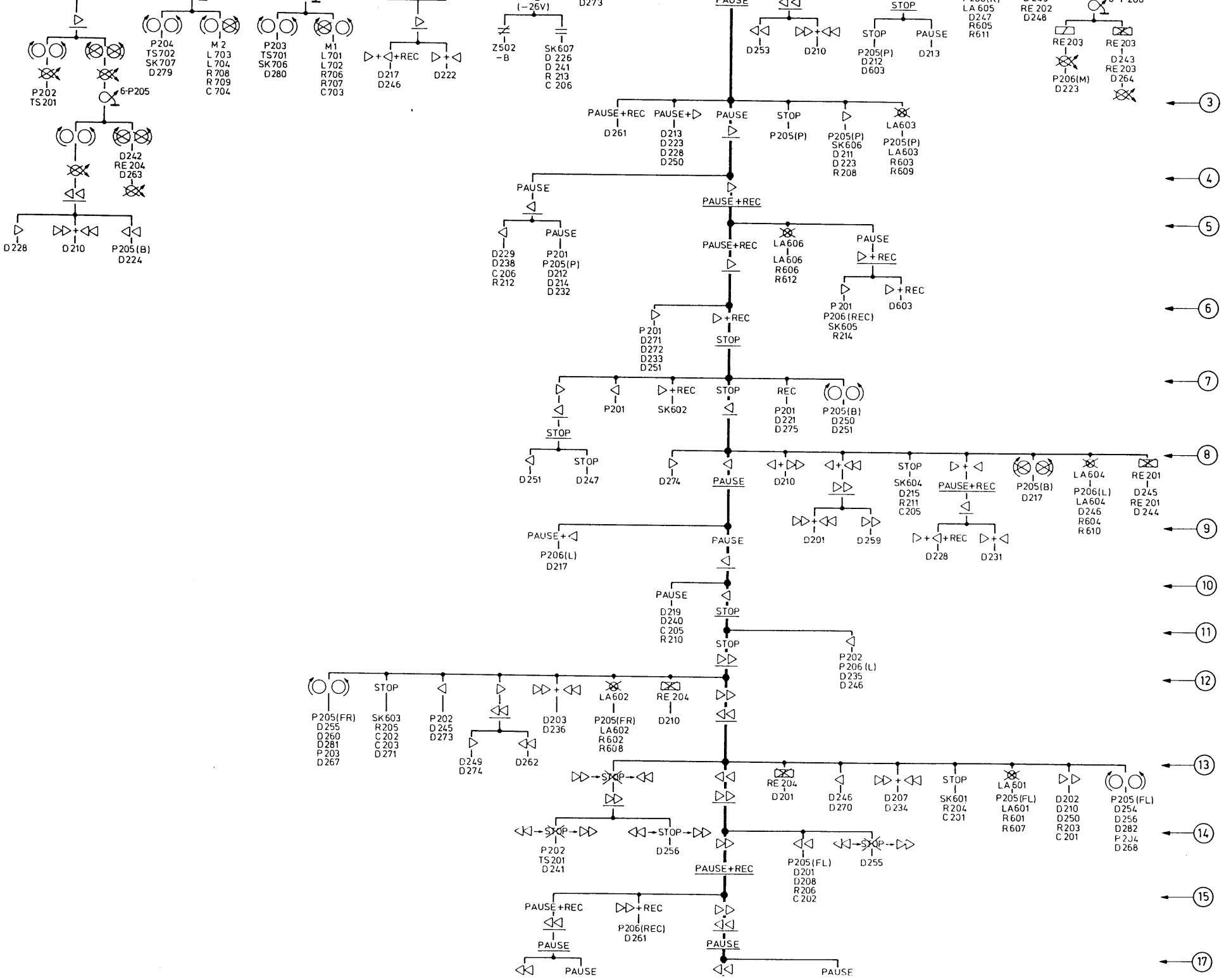

906D

CS31980

# Repair method N4450

B


10 → NOR
27 → NOR
34 → ON
M3
Z501
+A
P207
M3
10-12 SK6
STOP
PAUSE
REC
RE 203
P206(M)
P205(P)
P206(REC)
V
3-P205
(2,1V)
P205(B)
D213
D269
R201
P204
TS702
D277
P203
TS701
D278
P205(FR)
D206
P205
P205(FL)
D205
PAUSE+
P206(R)
D218
P206(L)
P201
P206(R)
D238
P201
D240
c-TS201
e-TS201
c-TS702
c-TS701
PAUSE+REC
STOP
V
−B
(−26V)
D237
D273
D201
P202
TS201
6-P205
P204
TS702
SK707
D279
M2
L703
L704
R708
R709
C704
P203
TS701
SK706
D280
M1
L701
L702
R706
R707
C703
D217
D246
D222
Z502
−B
SK607
D226
D241
R213
C206
D253
D210
LA605
P206(R)
LA605
D247
R605
R611
RE202
D249
RE202
D248
6-P206
RE 203
D243
RE 203
D264
P206(M)
D223
PAUSE+REC
D261
D213
D223
D228
D250
LA603
P205(P)
LA603
R603
R609
P205(P)
SK606
D211
D223
R208
D242
RE 204
D263
D228
D210
P205(B)
D224
D229
D238
C206
R212
P201
P205(P)
D212
D214
D232
LA606
LA606
R606
R612
+REC
P201
P206(REC)
SK605
R214
D603
P201
D271
D272
D233
D251
SK602
REC
P201
D221
D275
P205(B)
D250
D251
D251
D247
D274
SK604
D215
R211
C205
D217
LA604
P206(L)
LA604
D246
R604
R610
RE201
D245
RE201
D244
P206(L)
D217
D259
D228
D231
D219
D240
C205
R210
1
2
3
4
5
6
7
8
9
10
11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6-P205
D242 RE 204 D263
D228
D210
P205(B) D224
P204 TS702 SK707 D279
M 2 L 703 L 704 R 708 R 709 C 704
P203 TS701 SK706 D280
M1 L701 L702 R706 R707 C703
D217 D246
D222
(−26V)
Z502 −B
SK607 D 226 D 241 R 213 C 206
D273
PAUSE
D253
D210
STOP
STOP
P205(P) D212 D603
PAUSE
D213
LA 605 D247 R605 R611
RE 202 D248
RE 203
P206(M) D223
RE 203 D243 RE 203 D264
PAUSE+REC
D261
PAUSE+
D213 D223 D228 D250
PAUSE
STOP
P205(P)
P205(P) SK606 D211 D223 R208
LA603
P205(P) LA603 R603 R609
3
PAUSE
D229 D238 C206 R212
PAUSE
P201 P205(P) D212 D214 D232
PAUSE+REC
4
PAUSE+REC
LA606
LA606 R606 R612
PAUSE
+REC
P201 P206(REC) SK605 R214
+REC
D603
5
P201 D271 D272 D233 D251
+REC
STOP
6
STOP
P201
SK602
STOP
REC
P201 D221 D275
P205(B) D250 D251
7
STOP
D251
STOP
D247
D274
PAUSE
D210
STOP
SK604 D215 R211 C205
PAUSE+REC
P205(B) D217
LA604
P206(L) LA604 D246 R604 R610
RE 201
RE 201 D244
8
D245
PAUSE+
P206(L) D217
PAUSE
D201
D259
+REC
D228
D231
9
PAUSE
D219 D240 C205 R210
STOP
10
STOP
11
STOP
P202 P206 (L) D235 D246
12
P205(FR) D255 D260 D281 P203 D267
STOP
SK603 R205 C202 C203 D271
P202 D245 D273
D249 D274
D262
D203 D236
LA602
P205(FR) LA602 R602 R608
RE 204
D210
STOP
STOP
RE 204
D201
D246 D270
D207 D234
STOP
SK601 R204 C201
LA601
P205(FL) LA601 R601 R607
D202 D210 D250 R203 C201
P205 (FL) D254 D256 D282 P204 D268
13
STOP
STOP
P202 TS201 D241
STOP
D256
PAUSE+REC
P205(FL) D201 D208 R206 C202
STOP
D255
14
PAUSE+REC
PAUSE
PAUSE
+REC
P206(REC) D261
PAUSE
PAUSE
PAUSE
15
17

# Repair method N 4450

**A**